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The Cunard steamer "Campania," on Aug. 17, finished the run from Queenstown to New York in 5d. 9h. 29m., beating the best previous westward record, that of her sister ship the "Lucania," by 3h. 18m. The fastest previous westward passage of the "Campania" was 5d. 13.25m. She still holds the best eastward record of 5d. 12h. 7m., from Sandy Hook to Queenstown. On this last voyage the "Campania" left Liverpool on Aug. 11 and Queenstown on Aug. 12. Her day's runs reckoned from Daunt's Rock, at the entrace to Queenstown Harbor, were as follows, in knots: 516, 521, 543, 525, 545, 126. Her average speed throughout was 21½ knots per hour, and her average for one day (545 knots) was 22½ knots per hour. The distance travelled from Daunt's Rock to the Sandy Hook lightship was 2,776 knots. The weather was favorable with westerly and northwest winds; but on Aug. 15 she reduced speed for two hours on account of fog. She carried a full head of steam, 165 lbs., all the way across, except when fog-bound.

The late "caisson accident," at the Mare Island Navy Yard, is still unexplained in detail though a court of inquiry is now convened to investigate the affair. It is now said that the caisson was known to have been weak for some time past and that especial precautions should have been taken to prevent just such an accident. The result of this piece of carelessness is that the government is, for some time at least, left without a single dry-dock on the Pacific Coast, and the private docks at San Francisco can only accommodate vessels of the smaller class. This may seriously interfere with the government programme for sending the "Philadelphia" and the "Charleston" to the Chinese station, as intended, as both need docking badly. The only government docks really available are on the Atlantic Coast, at New York, Norfolk, and League Island, with a small stone dock at Portsmouth, N. H. None of these in use is large enough for the later warships, and the Navy Department is having trouble with the contractor for the new Brooklyn dock, designed to meet present needs. The Port Royal dock is approaching completion; but on the dock at Algiers, La., and the one at Puget Sound, which will eventually be the largest in the country, little more than a beginning has been made.

The effect of the Mississippi jetties upon the commerce of New Orleans was thus briefly outlined in an address of Mr. E. L. Corthell, to the alumni of Brown University, at Providence, R. I.; the tabulation is our own. The construction of the jetties was commenced in 1875 and on Jan. 9, 1879, the U. S. government engineer first certified to the existence of a channel across the bar, 200 ft. wide at 26 ft. deep and with a central depth of 30 ft. The comparative commerce of New Orleans for 1876 and 1892, as resulting from the change from 17-ft. to 30-ft. channel, is given by Mr. Corthell as follows:

	1876.	1892.
Total sea commerce....	2,000,000 tons.	3,333,000 tons.
Vessels passing.		
1,500 to 1,800 tons.....	70	145
1,800 " 2,000 "	23	80
2,000 " 2,500 "	34	110
2,500 " 3,000 "	0	112
Comparative dft. vessels	17½ ft.	26½ ft.
Value ocean commerce..	$137,000,000	$233,000,000

The Sixth Congress of Internal Navigation has lately closed its sessions at The Hague. Among the Americans present were Col. G. L. Gillespie, U. S. Engrs., representing this government; Mr. E. P. North, of the Am. Soc. C. E.; Mr. R. G. Packard, of Brooklyn, N. Y., and Prof. Wm. Watson, of Boston, Mass. In all 45 papers were presented upon subjects relating to internal navigation; but the chief attractions to visitors were the excursions to the river works at the Hook of Holland, to Rotterdam, Dordrecht, Scheveningen, Amsterdam, etc. The printed papers will be given in abstract later.

A passenger train made up of 25 passenger coaches and one baggage car, and carrying over 1,600 passengers, was hauled by one locomotive on the Jacksonville, St. Augustine & Indian River Railway, on Aug. 19. The run of 38 miles was made in a few minutes over one hour. The previous "longest passenger train" is said to have been one of 23 coaches on the "Memphis Route."

A triple valve for air-brakes, which permits the recharging of the auxiliary reservoirs while the brake is applied, has been invented by Mr. John M. Hurst, Master Mechanic of the Great Salt Lake & Hot Springs Ry., and was tested on a passenger train on the Utah Central Ry., on a special run made Aug. 16, with successful results, according to newspaper reports. The invention involves the use of a double line of train pipe, and is intended for use only for special service on steep grade mountain roads. We believe a triple-valve which permits recharging the reservoirs while the brakes are on has also been invented by Mr. J. Heron Crosman, of 50 Exchange Place, New York.

Cinder pits, for removing ashes and cinders from locomotives, is one of the subjects which is to be reported on at the meeting of the Association of Railway Superintendents of Bridges and Buildings. Mr. Walter G. Berg, Principal Assistant Engineer of the Lehigh Valley R. R., is chairman of the committee on this subject, and has sent out circulars requesting information upon it.

The Oahu Railway & Land Co., of Hawaii, has awarded a contract to A. Feek, of Seattle, Wash., for extending its narrow gage railway around the island. There are 19 miles now in operation, and 52 miles are to be built. The work will cost nearly $1,000,000. With the exception of some rock cuts the work will be comparatively easy. There will be two steel bridges 200 ft. long and the remainder of the bridges will be trestle work. The rails are to be of steel and the ties will be Puget Sound cedar and all of the bridge timber will be Puget Sound fir. Everything, with the exception of the rails, which will come from England, will be supplied from Puget Sound. The contract for furnishing 3,000,000 ft. of cedar and fir timber has been let to the Port Angeles Mill Co. The contract for putting in the bridge timbers, trestle work, tracklaying and surfacing has been let to J. N. Brickal, of Seattle. The grading will be done by Chinese and Japanese laborers.

The most serious railway accident of the week was a freight train derailment on the Wabash R. R., two miles west of Jonesboro, Mo., which occurred on the night of Aug. 20. The train struck a horse, and the locomotive and 19 cars were ditched. The engineer and three tramps were killed and the fireman, brakeman and six tramps were injured.

A feed-water heater and purifier in the power house of the Louisville, Ky., Electric Light Co. exploded on Aug. 13, killing one man and seriously injuring another. The purifier was 60 ins. in diameter and 24 ft. long. The head blew off, it is said, by the stripping of the threads on the bolts which secured it.

Two flywheel accidents are reported. On Aug. 8, at Portland, Ore., a 2,400-lb. flywheel on a small engine driving dynamos in the station of the Union Power Co., exploded, doing, however, little damage. The wheel was known to be defective when cast, and was only being run as a temporary makeshift.——On Aug. 10 a 50-ton flywheel in the engine room of the Nashua, N. H., Mfg. Co., gave way, injuring several persons. The engine was built by William A. Harris, of Providence, and the accident was caused by the dropping out of the taper-pin which held in place the bevel gear at the bottom of the governor. When this occurred the governor balls immediately slowed speed and dropped down, there being no automatic stop motion in connection with the engine.

The third issue of bonds of the Sanitary District of Chicago, amounting to $3,000,000, has been purchased by N. W. Harris & Co., of Chicago, at a premium of 0.57. The full list of bidders for this issue was as follows:

	Amt. bid for.	Rate.
E. J. Nelson.....	$25,000	100.5
Lee, Higginson & Co.....	1,000,000	100.126
First National Bank, Chicago....	750,000	100.516
A. O. Slaughter & Co.....	100,000	100.625
P. C. Peterson.....	100,000	100.5
Blair & Co., New York.....	3,000,000	100.375
N. W. Harris & Co.....	3,000,000	100.57

The successful bidders, it will be remembered, also purchased the second series of bonds, amounting to $3,000,000, at a rate of 100.792, or 0.222 higher than they bid for the last series. The first series of $2,000,000 of bonds were purchased by Blair & Co., of New York city, at 100.51. The present bonds bear 5% interest. The total issue of bonds up to date is $8,000,000.

In connection with the "cemented clay" controversy on the Chicago Drainage Canal, the publication by Mr. G.P. Brown on "The Drainage Channel and Waterway" has been brought into notice. This book describes fairly well the difficulties encountered by the contractors for the deepening of the Illinois and Michigan Canal, which is located close by the side of the drainage channel, and through the same geological formation. It is true that this book was not published under the auspices of the Drainage Board until after the contracts were let for sections 1 to 14 and sections C, D, E and F, and the charge is not made that the Board knew of this material before the letting. But the contractors and others contend that the Board should have known all about it,as the data were accessible on search for it, and it is to be supposed that any such organization would have made every effort to exhaustively study an engineering work preceding this one, through the same geological formation. Rumor has it that the contractors for the sections of the drainage canal affected will refuse to complete their work under the present contracts, and force the issue into the courts.

The diversion of the water of Niagara Falls has been made the subject of a committee report to the New York State Constitutional Convention. The committee was directed to determine if any amendment should be adopted restraining the State Legislature from granting further privileges to divert the water of the Upper Niagara River from its natural channel. The committee reports that the amount of water now taken from the river will not make an appreciable difference in the appearance of the Falls and the rapids above. At the present time the Niagara Falls Hydraulic Power & Manufacturing Co. has a canal, with a capacity of 211,000 cu. ft. per minute; and when the plans are fully carried out it will have a capacity of 462,000 cu. ft. per minute. The statute limit prescribed for the Niagara Falls Power Co. is 1,032,000 cu. ft. per minute. The total draft by these two companies is 1,494,000 cu. ft. per minute; or a little over 9% of the total flow of the river. The companies incorporated, but not yet in operation, are unlimited in the amount of water to be used. The only return made to the state of New York for these immensely valuable franchises is the promise to furnish the Niagara Reservation with water and light. The committee recommends that these companies should be placed under the Commissioners of the Niagara Reservation; these to have power to regulate amount of water used and compensation to be paid. The Legislature would have no power to grant further privileges.

Lake vs. land asphalt for street paving has been the subject of discussion in Cincinnati, and the Board of Administration has just pronounced in favor of the lake product. Their report was founded upon the investigations of City Engineer H. J. Stanley, Capt. G. J. Fieberger, U. S. Engineers, and Mr. Clifford Richardson, analytical chemist, of Washington, D. C. The samples of "land" asphalt submitted were condemned as inferior in quality to the "lake" asphalt and subject to rapid degeneration, and as generally unsuitable for paving purposes. The City Engineer recommends that future specifications for paving should read, "best grades" of "Rock asphalt," "Trinidad Lake asphalt," "Bermudez asphalt" and "Asphalt Block." This would, he says, give a sufficient number of bids and insure a standard quality. The "land asphalt" people have lately attempted, without success, to have the words "Pitch lake asphalt" eliminated from the paving specifications of St. Louis, Mo. The Board of Public Works of that city said that the present field was wide open to any company that would give the proper bond and maintenance guarantee; but it declined to limit possible competition to the St. Louis and the Barber Company.

Electric launches are to be used for the police patrol boats on the Philadelphia water front. Their silence and speed make them especially adapted to this work. The General Electric Launch Co. offered to build the first boat for $2,900.

STRONG'S INTERNALLY-FIRED BOILERS AT RIDGEWOOD PUMPING STATION.

We illustrate herewith a 2,000-HP. boiler plant recently installed at the Ridgewood Pumping Station of the Brooklyn Water-Works by the Edge Moor Iron Co., of Wilmington, Del. The boilers were designed and patented by Mr. Geo. S. Strong, M. Am. Soc. M. E. They are similar in general design to a Scotch boiler, but are longer and the return tubes are placed below the furnace, instead of above it, as in the ordinary marine boiler. The advantage claimed for this arrangement is that the tubes are in solid water, whereas when placed above the furnace, according to the common plan, they are immersed in the current of mingled water and steam rising from the furnace, and thus are not cooled as effectively and cannot so thoroughly extract the heat from the gases as when surrounded by solid water. It is further claimed that there is less liability to priming with this arrangement than when the ascending currents from the furnace have to pass among the tubes. Probably 80% of the steam is made by the furnace heating surface, and this large volume of steam is discharged near the water surface.

The furnaces are 7 ft. in length, from the fire-door to the bridge wall, and the portion of the furnace beyond the bridge wall is 11 ft. in length. The interior circulation is facilitated by plates, extending from a point near the water line to a point near the bottom of the boiler, thus preventing interference between the downward and upward currents.

The specifications under which this boiler was designed required the plant to show under test an efficiency of 10 lbs. of water evaporated from and at 212° per pound of anthracite coal. Each boiler was also required to have a capacity to evaporate 6,000 lbs. of water per hour and to be capable of evaporating 10,000 lbs. per hour without loss of efficiency and without priming. We are informed that other builders refused to attempt the contract and give such a guarantee.

Returning to the design of the boiler, the gases pass from the ends of the furnaces into a brick-lined chamber at the back of the boilers, which chamber is entirely airtight, so that the leakage of air is practically impossible. This back chamber, or combustion chamber, is provided at the bottom with a hopper (which may be opened by a slide) to receive any ashes that would otherwise be drawn into the tubes. The gases drop from the end of the furnaces into the tubes, through which they return to the front, and drop into an underground flue, or tunnel, which leads to the stack, located outside of the boiler house. There is a damper on the downtake of each boiler and a large damper on the main flue, just inside the wall of the boiler room, the latter controlled by an automatic regulator.

The boilers are supported on a pier at the front where they are built into the flue, and at the back they are carried on a rocker with a safety pier, so that they are free to contract and expand without breaking loose at the place where the flue connection is made, and no leakage of air into the flue can take place.

The boilers are covered with 3 ins. of magnesia, with a 1-in. space under the covering, so that very little heat is radiated and the boiler room is comfortably cool in warm weather, while in winter, with no other means of heating, a man would find it necessary to go fully clothed or to work to keep warm. Thus the large loss by radiation usual with brick-set boilers is avoided. With an internally-fired boiler, all the radiation of the heat of the fire has to take place through the water; thus the radiation from the boiler is only that due to the temperature of the water or steam, which at the pressure of 110 is 344°, while the temperature of the furnace would be 2,000° to 2,500°. The difference in loss by radiation can be readily appreciated.

The difference in economy between an internally-fired and an externally-fired boiler, due to air leakage, is not so generally understood as it should be. Mr. B. F. Isherwood, in the discussion before the Mechanical Engineers last spring (Eng. News, May 17, 1894), set the average loss of the externally-fired boiler from air leakage at 10%.

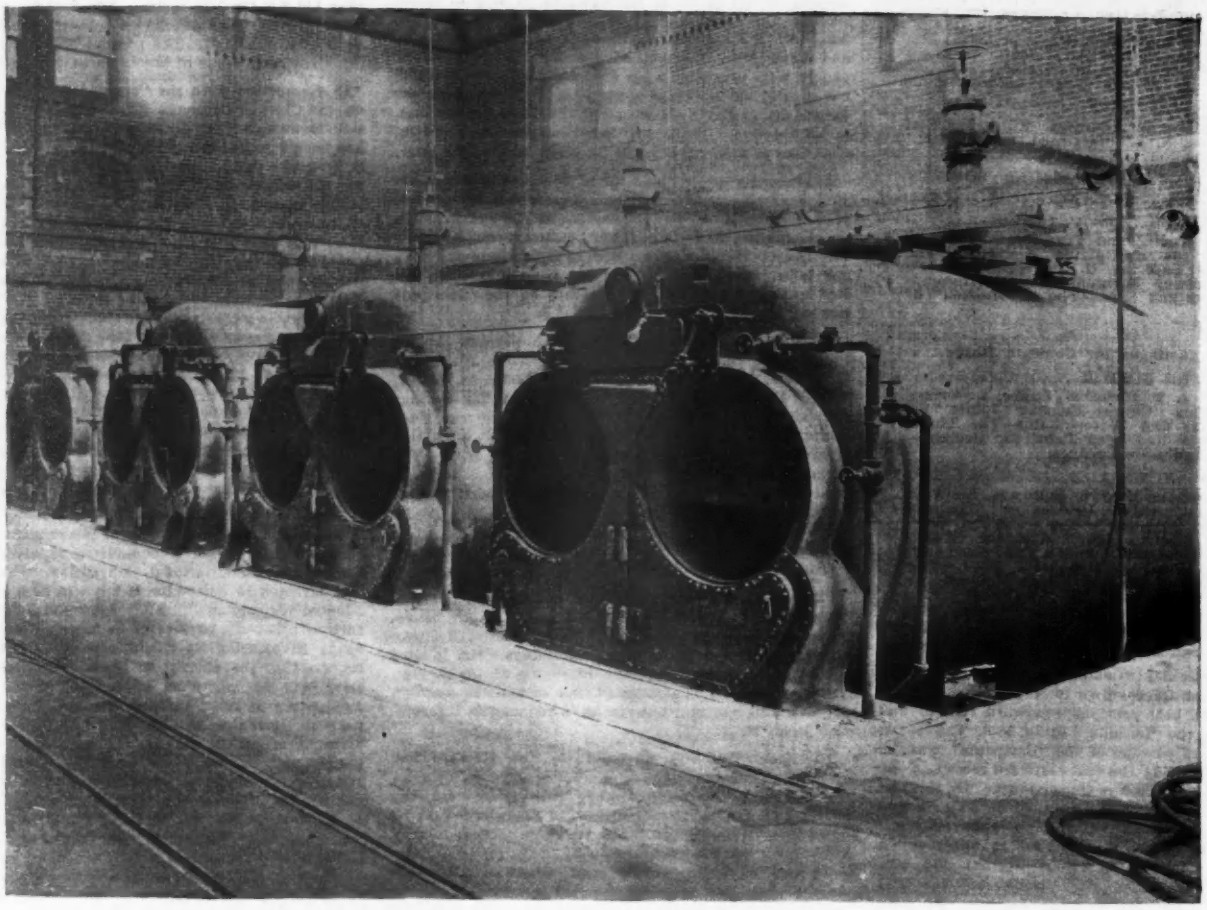
With the boilers shown in our illustration, high rates of combustion, up to 20 lbs. of coal per sq. ft. of grate per hour, can be secured without loss of efficiency and without the slightest chance of injury to the boiler.

The makers have arranged to fit these boilers with the Vicars automatic stoker when desired. This stoker is quite different from American stokers, which were described in our issue of Aug. 9 and which are all designed for externally-fired boilers. The Vicars stoker is extensively used in England, and is claimed to considerably increase the capacity of the boiler over the normal capacity with hand firing.

The battery of boilers which we illustrate was tested by the Brooklyn Water Department on April 25 to 28, 1894. The coal was Plymouth anthracite, taken from the overflow of coal in the pocket and not specially screened. The following gives the main results of the test:

Length of run, hours	8	24	8
Temperature, feed	129°	167°	174°
" engine room	83°	84°	79°
Steam pressure, lbs.	107.5	109.4	109.4
Dryness of steam	0.992	0.989	0.997
Coal used, lbs.	5,280	16,026	5,120
Percentage of ash	9	9	9
Water actually evaporated per lb. coal, lbs.	10.13	10.34	10.60
Water evaporated from and at 212° per lb. coal, lbs.	11.33	11.22	11.43
Do. per lbs. combustible, lbs.	12.46	12.33	12.56

The report is signed by Mr. L. Russell Clapp, Assistant Engineer, who states that the boilers showed an increased efficiency over boilers of the ordinary type used elsewhere on the Brooklyn water-works.



STRONG'S INTERNALLY-FIRED BOILERS AT RIDGEWOOD PUMPING STATION, BROOKLYN WATER-WORKS.

SPECIFICATIONS FOR ELECTRICAL SUBWAYS AT BALTIMORE, MD.

The city of Baltimore is about to construct electric subways, in which will be placed its fire-alarm telegraph wires and the wires connecting its police stations, police patrol boxes, etc. The work is in charge of a city subway commission, of which Mr. N. S. Hill, Jr., 508 Equitable Building, is Chief Engineer. We are indebted to Mr. Hill for a copy of the specifications, and deem them of especial interest, as few complete specifications for electrical subways have ever been made and fewer

still have been published. We, therefore, reprint the specifications, practically in full, as follows:

1. It is not the object of these specifications to limit contractors and manufacturers in the choice or design of details.

2. Estimates will be received for the four following types of conduit, and these types only: (1) Creosoted wood conduits; (2) Treated wrought iron pipe, laid in concrete; (3) Cement-lined tubes, laid in concrete; (4) Terra cotta tubes, laid in concrete.

All estimates must conform to the specifications and schedule at the back of these specifications, and must be submitted upon these schedules. No bids will be recognized unless submitted in the manner prescribed. The price per foot per duct for trunk lines and laterals to include all the materials and work necessary to complete the conduits, connect them into the manholes of the Chesapeake & Potomac Telephone Co. where directed, and restore the paving, exclusive of the cost of manholes, distribution boxes and subsidiary ducts. Estimates for manholes and distribution boxes must include everything pertaining to a complete manhole or distribution box. The estimate for subsidiary ducts to include connections with the distribution box or manhole and leading the duct into the post, or up the pole, supporting the fire alarm or police patrol box, and at least 18 ins. above the sidewalk or into the buildings to which distribution is made. The cast iron posts called for in schedule shall be of suitable design to accommodate either the police patrol or fire alarm boxes, or both. The estimate should include setting, restoring paving, painting, etc.

3. Contractors will, if requested, furnish itemized estimates, which will show in detail the character and cost of the materials and labor which they propose to furnish for each part of the work.

4. Contractors must furnish, with their estimates, detailed drawings and specifications for the system which they propose to construct; said specifications to cover in detail all the requirements called for in these specifications.

5. Contractors shall place the conduits in the streets indicated upon plats which will be furnished by the Engineer of the Subway Commission, and shall build the conduits of the size, capacity and length as set forth in schedules which will be furnished by the Engineer of the Subway Commission.

6. Conduits must be so constructed as to protect cables placed therein from any or all injury which may result, from the failure of the conduits when subjected to the tools of workmen engaged in other and outside work, from burrs or sharp edges in the conduit due to faulty construction of the conduits, from the destructive action upon the lead cable casing, arising from the presence of chemicals used in the manufacture of the conduits, or from any other source.

7. Provision must be made for laying, inspecting and removing cables, and contractors must in every instance place "drawing-in" wires in position in all ducts; said wires to be No. 10 B. & S. gage galvanized iron, as free from joints as possible. Joints to be strong and close to prevent fouling in pipes. All bends in conduits and ducts must be of a suitable radius to allow free passage of the cables. Sharp corners in manholes and distribution boxes, where conduits are connected into manholes, shall be avoided, and all corners shall be rounded off. Manholes and distribution boxes must be so designed as to allow ample room for splicing, testing, etc.

8. All distribution must be made underground. Distribution boxes must be placed opposite all points where fire alarm boxes, engine houses, etc., are located, and at other points as directed by the Engineer of the Subway Commission. Subsidiary ducts must be led to all posts or poles upon which alarm boxes or patrol boxes are located, and into engine houses and other buildings where circuits are to be carried. The method of leading ducts into cast iron posts, of fastening them to telegraph poles, etc., upon which alarm or patrol boxes are located, and the provisions to be made for protecting and drawing in wires to be connected to said boxes, must be described in the specifications submitted by contractors. At points where the conduit system ends and the wires are carried overhead, a duct must be led to and up the poles, as directed by the Engineer of the Subway Commission.

9. Contractors must make provisions for future additions, so that, should future requirements call for increased capacity, the capacity of the conduits may be readily increased.

10. All conduits and manholes must be water-tight and every precaution must be taken to prevent gas leakage. All joints must be tight and well made. Means of ventilation must also be provided, which shall efficiently relieve the conduits of any gas, which may leak into them, despite precautions to prevent it.

11. Contractors must provide means to protect cables laid in their system from electrolysis and must fully describe in their specifications the methods they propose to prevent it.

12. All trunk line conduits and laterals must be laid in trenches of suitable depth, all trenches to be leveled to grade. When types No. 2, No. 3 and No. 4 are proposed, the trunk line conduits and laterals must be laid in concrete, said concrete to fulfill the requirements of the specifications for that material. When type No. 1 is proposed, the conduits must, in every case, be laid upon a 2-in. creosoted wood plank and be protected by a 2-in. creosoted wood plank laid on top. The creosoted wood ducts, wrought iron tubes, cement-lined tubes and terra cotta tubes must conform to the special specifications for these materials.

13. Subsidiary ducts may be laid 6 ins. below the surface of the street paving. "Extra Strong" wrought iron tubes laid directly in the earth are preferred for this work. Ducts shall, in every case, have easy

14. Manholes shall be constructed of brick laid in cement mortar, with cement bottom (see specifications for brick and cement mortar), and have a cast iron frame (see specifications for cast iron) placed over all, the top of which shall be arranged to come flush with surface of street. The joints between the conduits and manholes must be carefully made to prevent any leakage from water or gas. The cast iron frame shall be well bedded, on the top of the brick walls, in cement mortar. Care shall be taken to lay the cement mortar sufficiently thick to insure a tight joint all the way around the manhole. The entire surface of the frames, before being placed in position, shall be treated with P. & B. paint or some other equally good material, to be approved by the Engineer of the Commission. Manholes shall be provided with double covers, the bottom cover to be water-tight. The upper cover shall be sufficiently strong to bear the heaviest loads to which it may be subjected under ordinary traffic. Each upper cover shall have cast on it the initials "P. & F. A. T.," and in addition shall have a number cast on it, commencing with number 1, no two covers having the same number. The covers to be placed as directed by the Engineer of the Subway Commission. Hangers shall be placed in rows at the side walls of the manholes to carry the cables. There shall be as many rows of hangers in any particular manhole as there are ducts in the conduits entering that manhole. The hangers shall be divided equally between the two sides of a manhole.

15. Distribution boxes shall be built of brick with cast iron covers and cement floors where conduits of types No. 1, No. 3, No. 4 are proposed. Where type No. 2 is proposed, either the above form or cast iron distribution boxes may be used. When cast iron is used the iron must conform to the special specifications for cast iron and the entire surface of the distribution box, inside and outside, must be treated with P. & B. paint or some other equivalent material to be approved by the Engineer of the Subway Commission. Board racks must be placed at the bottom of all distribution boxes to support the cables and remove them from the floor of the boxes. The materials and methods of construction to be employed where brick distribution boxes are proposed must fulfill the requirements of the specifications for manholes. All distribution boxes shall have double covers, and the upper covers shall be numbered

Specifications for Creosoted Wood Ducts.

The wood to be used shall be untapped Southern yellow pine, free from knots, wind or heart shakes, and other defects. The wood shall be treated with 12 lbs. of the creosoting liquor per cubic foot. The creosoting liquor is to be of the description known as heavy oil of tar, obtained by the distillation of coal tar, and consisting of that portion of the distillate which comes over between the temperatures of 350° F. and 760° F.

The liquor must be free from admixture of any oil or other substance not obtainable from such distillate. It shall contain not less than 20%, nor more than 50% of constitutents that do not distil over at a temperature approaching 600° F. It must yield not less than 9.0% by volume of tar acids.

The creosoting liquor must become completely fluid when raised to a temperature of 100° F., and exhibit no signs of any deposit on cooling down to a temperature of 93.5° F. The specific gravity of the liquor must not be less than 1.035, nor more than 1.085 at a temperature of 90° F. as compared with water at 60° F.

Specifications for Wrought Iron Pipe.

Two grades of pipe will be used, known as "Standard" and "Extra Strong." "Standard" pipe to be used on trunk lines and laterals, and wherever the pipe is laid in concrete. "Extra Strong" to be used for subsidiary ducts and wherever pipe is laid directly in the ground. The pipe is to be free from burrs, to be connected with screw couplings, and when completed must be water-tight. The material desired for pipe is soft, homogeneous, puddled iron or steel. Pipe must conform to dimensions in the following table:

—Diameter.— Nom'l inside, ins.	Act'l outside, ins.	No. thrds. per in.	—Standard.— Thickness, ins.	Wt. per ft., lbs.	—Extra Strong.— Thickness, ins.	Wt. per ft., lbs.
1	1.31	11½	0.134	1.67	0.192	2.17
1½	1.90	11½	0.145	2.68	0.203	3.63
2	2.37	11½	0.154	3.61	0.221	5.02
2½	2.87	8	0.204	5.74	0.280	7.67
3	3.50	8	0.217	7.54	0.304	10.25

Pipes must not vary more than 5% from weights given in table. All pipes must have a vanishing thread as employed for pipes used in the New York subways. Any piece showing mechanical defects or showing much variation from dimensions given will be rejected. When the number rejected amounts to 20% of the entire shipment, the entire shipment will be rejected. All pipes must be treated inside and outside with asphaltum applied while hot.

Specifications for Cement-Lined Pipe.

The tubes shall be lined with ⅝ in. of pure cement (no sand or other injurious matter being used), the cement to fulfill the requirements of the special specifications for cement. The interior surface of the cement lining must be smoothly finished, true and cylindrical, and of the specified diameter. The thickness of the cement lining shall be full ⅝ in. throughout the entire length of each tube. For every 100 tubes, contractors must furnish one extra tube which shall be picked at random from a pile of 100 tubes, and cut by the inspector at any point in its length, and the thickness of the lining measured. Should the lining at any point in this tube fall below ½ in. in thickness, the lot of 100 tubes will be rejected. If the lining is of the required thickness throughout, the lot of 100 will be accepted.

The wrought iron used in the shell of these ducts shall be of good quality, capable of being bent and twisted without breaking, and the weight shall be 0.72 lbs. per sq. ft., equal to No. 26 B. W. G. Every shell shall be thoroughly riveted with rivets of the proper size and weight, and the rivets shall be not more than 1½ ins. apart.

Specifications for Terra Cotta Tubes.

Terra cotta tubes shall be of the best manufacture, sound and thoroughly burnt throughout their whole substance, and the internal and external surfaces smooth and well glazed. They shall be cylindrical in bore, and internally of the full specified diameter. The thickness shall be uniform throughout the entire body of the tubes. All tubes shall be made to fit without being chipped.

Specifications for Bricks.

All bricks must be of standard size 2 × 4 × 8¼ ins., regular in shape, tough and burned hard entirely through. Bricks must not contain lime or other soluble substances in sufficient quantities to produce spalling or splitting when soaked in water for three consecutive days. Bricks must be non-porous, and must not absorb more than 6% of their weight of water when immersed for 24 hours.

Specifications for Cement.

The cement to be used on the work herein described shall be a good quality, fresh and finely ground Rosendale, or other equally good cement, to be approved by the Engineer of the Subway Commission.

Specifications for Concrete.

Concrete shall be composed of 4 measures of oyster shell, 2 measures clean, sharp sand and 1 measure of cement as previously described; to be made and thoroughly mixed just before using, and well rammed in place; the cement and sand to be mixed dry before the incorporation of the oyster shells. It must contain just sufficient water to film the surface of the concrete when rammed, but not enough to make it quake. Concrete must be mixed on wooden mortar beds.

Specifications for Cement Mortar.

The cement mortar must be made of cement as previously described, in proportion of 1 part of cement to 2 of clean, sharp sand, or such other proportion as may be required by the Engineer of the Subway Commission. The cement mortar shall be mixed only as required for use, and must be used as soon as mixed, as none left standing until set will be allowed in the work. It must be mixed on wooden mortar beds.

Specifications for Cast Iron.

Castings for manhole, and distribution box frames and covers, and other work, must be of good, sound iron, free from flaws. Castings must have a good, clean, smooth surface, free from fins and other imperfections, and must conform to drawings. No letters or numbers to be used except as directed by the specifications.

The form of contract which accompanies the specifications provides that all work shall be done under direction of the Engineer of the Subway Commission, who may appoint inspectors to oversee the work. The prices bid must include all labor and materials and every item of cost, together with any additional expense for any part of the work consequent upon obstructions met with or difficulties encountered of any character whatsoever.

The contractor agrees to guarantee his system in all respects and make all repairs and pay for any or all damages resulting from the use of poor materials or defective design for a period of five years from the completion of the conduits, and must further file a bond to insure prompt repairs or payment of damages as aforesaid with the Subway Commissioners.

The engineer has the right to order the discharge of any man in the contractor's employ who is, in his opinion, incompetent or unfaithful.

The contractor agrees to pay the sum of $20 per day for every day elapsing between the contract date for completion and the time of final completion. He agrees to give his constant personal attention to the work, and agrees not to sublet it or any part thereof without the written consent of the Subway Commissioners, nor to assign any of the moneys payable under it. He will place proper guards around all excavations and keep lights burning on them from sunset to sunrise, and must bear all damages resulting from any act or omission of his or his agents. We reprint other items of the agreement, as follows:

11. And the said contractor further agrees that if the work done under this agreement shall be abandoned, or if at any time the Subway Commissioners shall be of the opinion, and shall so certify in writing, that the said work, or any part thereof, is unnecessarily delayed, or that the said contractor is willfully violating any of the conditions or covenants of this contract, or executing the same in bad faith,or that the work is not being done according to the terms of this contract, or if the said work be not fully completed within the time named herein for its completion, the said commissioners shall have the power to notify the aforesaid contractor to discontinue all work under this contract, or any part thereof, by a written notice to be served upon the contractor either personally or by leaving the same at his residence or with his agent in charge of the work, and thereupon the said contractor shall discontinue said work or such part thereof, and the said commissioners shall thereupon have the power to place such and so many persons as they may deem advisable, by contract or otherwise, to work at and to complete the work herein described, or said part thereof, or so much of said work or said part thereof as the Subway Commissioners may direct, and to use such materials as they may find on the work, or to procure, or cause to be procured by contract or otherwise, all other materials for the completion of the same, and to charge the expense of said labor and materials to the aforesaid contractor, and the expense so charged shall be deducted and paid by the Subway Commissioners out of such moneys as may be then due or may at any time thereafter become due to the said contractor, under and by virtue of this agreement or any part thereof; and in case the expense is less than the sum which would have been payable under this contract if the same had been completed by said contractor, he shall forfeit the difference; but in case the expense shall exceed the last said sum, he shall pay the amount of such excess to the Subway Commissioners; and when any particular part of said work is being carried on under the provisions of this article of the contract, the aforesaid contractor agrees to continue the remainder of the work in conformity with the terms of this agreement, and in such manner as in nowise to hinder or interfere with the persons or workmen employed by the Subway Commissioners to do any part of said work or to complete the same under this article.

13. The contractor agrees to sustain, in their places, by suitable means, without injury, all the main and service water pipes and sewers which may be affected in any manner by the work to be done in the construction of the conduit system, and to protect all pipes from freezing. In the event of a failure to do so, the contractor further agrees that the Subway Commissioners shall be authorized to have replaced such pipes, mains or sewers, and to have the same recalked and repaired immediately, in each block as the work progresses, the cost therefor to be charged to the contractor; the cost so charged to be deducted from any sum or sums due or to become due or payable to the contractor under the terms of this agreement.

14. The contractor agrees to give notice, in writing, 24 hours before ground is broken for the purpose of constructing conduits, to gas companies having mains or pipes which may be affected by such excavations as may become necessary.

15. The contractor agrees to do everything necessary to support and sustain the gas pipes laid in or across streets where conduits are to be laid and which may be liable to injury from digging trenches for the work herein mentioned; and the contractor further agrees to cause no hindrance to or interference with any gas company or companies in protecting their said pipes, nor in removing or otherwise protecting or replacing the main and service pipes where necessary, but that the contractor will suffer said company or companies to take all such measures as may become necessary for the purpose aforesaid.

16. The contractor agrees that in case any damage or injury shall or may result to the said main and service pipes or other works of the gas company, through or by reason of any carelessness, negligence or want of skill on the part of the contractor, his agents or servants, he shall become liable to pay such amount as shall or may be sufficient to cover the expense and damage occasioned by such negligence, carelessness or want of skill, and that such amount shall or may be charged against the contractor and may be deducted from any sum or sums due or to become due or payable to the contractor under the terms of this contract.

17. The contractor agrees that wherever the conduits hereinbefore mentioned are to be connected into the manholes of the Chesapeake and Potomac Telephone Company he shall perform the work in the manner prescribed and according to the wishes of the said company, and the contractor further agrees to do everything necessary to support and sustain the conduits of the said telephone company which may be liable to injury from digging the trenches for the work herein mentioned, and to protect the manholes of said company from any damage whatsoever.

18. The contractor agrees that, in case any damage or injury may result to the said conduits or manholes, or other works of the said company through or by reason of any carelessness, negligence, want of skill, or failure to comply with the wishes of said company on the part of the contractor, his agents or servants, he shall become liable to pay such amount as shall or may be sufficient to cover the expense and damage occasioned by such negligence, carelessness, want of skill or failure to comply with the wishes of said company, and that such amount shall or may be charged against the contractor and may be deducted from any sum or sums due, or to become due, or payable to the contractor under the terms of this contract.

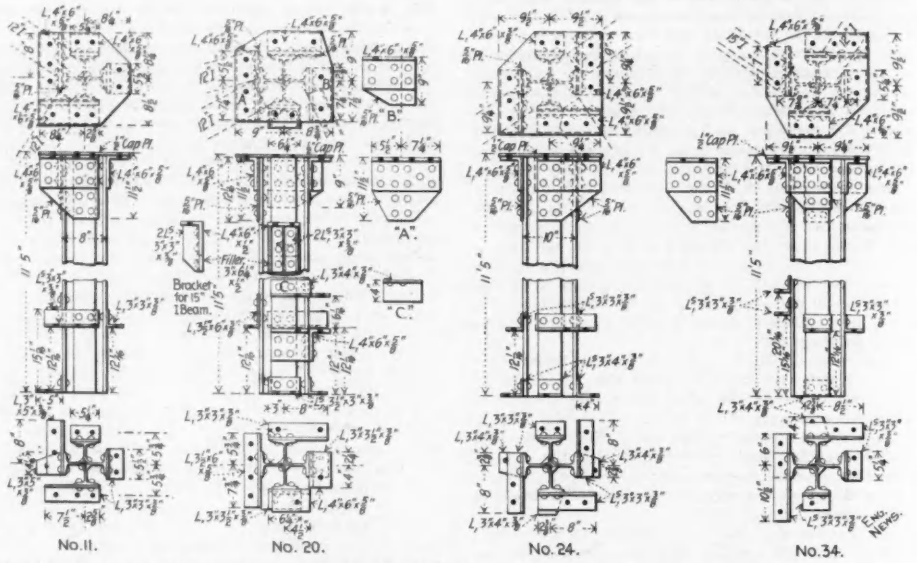
19. The contractor agrees to protect all other property which may be affected by the work herein described from any damage whatsoever, and further agrees that in case any damage or injury may result to the property of another from any carelessness, negligence, or want of skill on the part of the contractor, his agents or servants, he shall become liable to pay such amount as shall or may be sufficient to cover the expense and damage occasioned by such negligence, carelessness and want of skill, and that such amount shall or may be charged against the contractor and may be deducted from any sum or sums due or to become due, or payable to the contractor under the terms of this contract.

20. And the contractor further agrees that if before the completion of the work contemplated herein it shall become necessary to do any other or further work on or about the same than is provided for in this contract, he will not in any way interfere with or molest such other person or persons as the Subway Commissioners may employ to do such work, and will suspend such part of the work herein specified, or will carry on the same in such manner as may be ordered by the Engineer of the Subway Commission, so as to afford all reasonable facilities for the doing of such work; and no other damage or claim by the said contractor therefor will be allowed, except such extension of the time specified in this contract for the performance thereof as the said commissioners may deem reasonable.

21. And it is hereby expressly agreed and understood by and between the parties hereto that the said contractor shall and will at all times indemnify and save harmless the said Subway Commissioners against any and all loss or damages, cost or expenses arising out of any claim or suit for infringement of any patent or patents affecting any articles furnished under this contract.

COMPLICATED BEAM CONNECTIONS, HUCK & YOUNG BUILDING, CHICAGO.

The important part which the form of the column plays in designing satisfactory details for floor beam connections is well known to engineers familiar with high steel building construction. Where the beams are equally and symmetrically distributed, a satisfactory detail can be made for almost any column, but this regular arrangement is not always possible. Architectural exigencies often require the greatest latitude in the arrangement of the beams, both in plan and as to height, and when this is the case it becomes very important that the section of the column should afford as much opportunity as possible for the connection of plates and angles.



FLOOR BEAM CONNECTIONS FOR LARIMER COLUMNS, THIRD FLOOR OF HUCK & YOUNG BUILDING, CHICAGO.

The illustrations show the floor beam connections of four Larimer columns taken from the third floor of the Huck & Young Building in Chicago. This is a seven story structure with a trapezoidal floor plan and having a large rectangular air shaft in the center, which necessitated, as will be seen, a somewhat irregular arrangement of the beams. The drawings show the details of the connections so clearly that no description is necessary. We are indebted to Mr. Henry Ives Cobb, the architect of the building, and to Jones & Laughlins, the contractors for the ironwork, for the drawings from which our illustrations have been prepared.

PROGRESS IN MOTOR-DRIVEN CARRIAGES FOR HIGHWAYS.

The "Petit Journal," of Paris, some time ago offered prizes for a competitive exhibition of road carriages operated by other means of traction than horses. The public exhibition took place on July 18, at Neuilly, and from the report in "The Engineer" we obtain the following information:

In all, 26 vehicles were presented, differing widely in form and size. The conditions of the competition required that each carriage should be capable of carrying at least four persons, though no restriction was put upon the seating capacity. Security, easy management and cheapness were essential features. In a preliminary run each carriage was to make 31 miles in four hours, an average of 7¾ miles per hour being considered sufficient for ordinary use. No notice was to be taken of speeds exceeding this. Five prizes were offered of $1,000, $400, $300, $200 and $100. It is well to remark that by the French law of Aug. 14, 1893, no self-moving vehicle is permitted to travel along public roads in towns at a speed exceeding 7.44 miles (12 kiloms.) per hour, nor at a speed exceeding 12.4 miles (20 kiloms.) in the open country. This law applies to the whole Department of the Seine. As a large number of these vehicles could not compete together on a public highway, six routes were selected, running out of Paris, and being from 29 to 34 miles in length.

Among the motor-carriages presented for the test the following will serve as illustrations of the principal types. Two varieties of the Daimler-gasoline motor were present. This motor has sufficient power to produce a speed of 9.3 to 11.2 miles per hour on a level, dry road in good condition, and 2½ to 3 miles per hour up inclines of 1 in 12 and 1 in 10. The vehicle can be run at two different speeds and the motor is designed for the number of passengers required, allowing 165 lbs. per passenger. In the four-seated "Victoria" presented for trial the motor is placed under the rear seat. The extreme dimensions are 8.86 × 4.85 ft.; the gage is 4.26 ft., with the weight not given. The frame is made of weldless steel tubes, joined by cast steel connections, and the wheels are made like those of a bicycle, with pneumatic tires. The price of this carriage, complete in Paris, is $1,340. Another carriage of the same type costs $1,240 and is 8.4 ft. long and 4.6 ft. wide, with a gage of 3.94 ft. It is of the phaeton form.

The correspondent of "The Engineer" says that in operation the smell of the exhaust is noticeable, especially in mounting inclines. But the most objectionable feature is the excessive vibration of the carriage while at rest with the motors still running, but unconnected. The motor is placed upright in the carriage, with the two cylinders at right angles to the axis of the carriage, and two trunk pistons connected to one crank pin. The gas acts explosively and alternately in the two cylinders and power is conveyed to the wheels by gearing.

In the Panhard & Levassor carriage the Daimler motor is used, but it is placed in front of the dash-board and underneath the floor. This position is objectionable on account of smell. The Dion, Bouton & Co.'s steam bogie carriage was really made up of two separate vehicles. The first was four-wheeled, carrying a vertical boiler on the front axle, fed with coke from above through a central tube leading to the fire-grate. The steam operates a compound horizontal engine placed under the foot-board and partly beneath the front seat. Under the footboard is also the water reservoir. The second part of this vehicle is simply a wagonette or victoria, on two wheels, connected to the back of the motor proper.

The steam pressure at starting was 163 lbs., and never fell below 140 lbs. The weight of the motor itself loaded is 2 tons, and it is said to be capable of drawing a load of 1.2 tons at a speed of 12.4 miles up a gradient of 1 in 12½. It will carry sufficient coke for a journey of 62 miles, and water enough for about 25 miles. Steam can be raised in 15 minutes, it is claimed. The exhaust is carried away at the back by a tube; though this discharge is annoying to any one coming immediately behind. No chains are used in conveying power to the axles, the driving shaft being connected by Hooke-joints. The engine can develop 20 HP. and a speed of 21 miles per hour was often obtained. The whole journey of 35 miles was made in 3 hours, not including stops. While well adapted for hauling goods, "The Engineer" says this carriage will not do for family use, as the presence of a skilled mechanic is absolutely essential.

Out of the 102 carriages which originally entered for the competition 46 were finally listed as probable starters, though the number finally dwindled down to 26 actual competitors. The list given of the 46 is interesting as showing the varieties of motors now proposed. This showing is given as follows:

Petroleum motors (10 of the Daimler type)	23
Steam	12
Actuated by levers	2
Steam and petroleum (Serpollet boiler)	2
Compressed air, at constant pressure	2
Compressed gas	1
Electricity	1
Various	4

As seen, the petroleum motor is ahead of all, and the Daimler type seems the favorite. Steam comes next, with the Serpollet boiler in use in some of them. Electricity cuts no figure at all, though "The Engineer" illustrates an electric carriage made by Taylor, Cooper & Bednall, of Coventry, for Messrs. Blumfield & Garrard. This vehicle carries four persons in a mail phaeton, and it weighs about 1,000 lbs. ready for use. In its construction are combined pneumatic tires, balance gear, steel tubing, ball-bearings and electric power supplied through an accumulator. There are 24 accumulator cells in boxes beneath the seats, weighing about 500 lbs. The motor is under the carriage body and operates the hind axle through roller disks, toothed gearing, a chain and balance gear. The electric motor runs at a constant speed, and all gradations of power and speed are made by the shifting roller between the two disks. The machine is calculated to run at speeds varying from 3½ to 13½ miles per hour, according to gradients. In the 18-mile trial trip to Birmingham it is said to have made 10 miles per hour frequently, and one charging of the accumulator will run it 80 miles at a cost for charging of 75 cts. The maximum discharge capacity required is 2 HP.

The "Petit Journal" prizes were awarded on July 23, the first prize going to the Daimler type of motor. The second prize went to the steam bogie of Dion, Bouton & Co., and the third to a steam motor with Serpollet boiler. The latter type was especially commended as suitable for heavy omnibus work.

THE RAILWAYS OF THE UNITED STATES IN 1893.

Railway progress in the United States for 1893 is outlined as follows in the introduction to "Poor's Manual" for 1894, just issued in advance form:

	Miles.
Length of track laid to Dec. 31, 1893	177,753.36
Completed to the close of the several fiscal years	175,441.77
Completed since close of the fiscal years	2,311.59
Net increase of mileage in calendar year 1893	2,549.26
Net increase reported in fiscal year 1893	3,575.48

The liabilities and assets of the companies owning the above 175,441.77 miles of line are given as follows:

Liabilities.	
Capital stock	$5,080,032,904
Funded debt	5,570,292,613
Unfunded debt	410,361,503
Current debt	383,201,872
Total liabilities	$11,443,888,892
Assets.	
Cost of railroad and equipment	$9,661,713,736
Real estate, stocks, bonds and other investments	1,698,306,963
Other assets	248,945,157
Current accounts	247,002,310
Total assets	$11,855,968,166
Excess of assets over liabilities.	$412,079,274
" " " of various railroad companies	$586,535,623
Excess of liabilities of various railroad companies	174,456,349
	$412,079,274

Note.—The mileage, liabilities and assets of elevated railroads are included above.

The statistics of operations, during the fiscal year of 1893, exclusive of elevated railways, cover 173,370.07 miles of railway. These statistics are given as follows:

Passenger train mileage	340,352,211
Freight train mileage	531,340,754
Mixed train mileage	17,751,928
Total revenue train mileage	889,444,893
Passengers carried	628,965,973
Passengers—Mileage	15,246,711,952
Tons freight moved	757,464,480
Tons freight moved one mile	90,552,087,280
Earnings.	
Passenger	$311,978,342
Freight	808,494,668
Other	88,168,488
Elevated railroads	13,976,792
Total traffic revenue	$1,222,618,290
Operating expenses	858,027,181
Net earnings	$364,591,109
Other receipts, including rentals received by lessor companies	111,288,482
Total available revenue	$475,880,041
Payments.	
From available revenue: Interest on bonds	$239,616,284
Other interest	7,123,246
Dividends	95,337,681
Rentals, tolls, etc.	64,712,868
Miscellaneous	38,288,761
Total	$445,078,840
Balance.—Excess of available revenue over actual payments therefrom for the year	$30,801,201

Note.—The liabilities, gross and net earnings, interest and dividend payments, etc., of the elevated railroads in the State of New York are not included in the above table. The earnings of these lines are derived chiefly from passenger traffic, but their earnings cannot be included under that head for the reason that, if included, the deductions from the totals thus arrived at would be misleading. The statistics of passenger traffic and train mileage are omitted for the same reason.

For purposes of general reference, the following exhibit is a very useful one, for the years 1892 and 1893, for the whole United States. The Manual also divides this exhibit into groups of states, but limited space forbids its insertion here. This statement covers the mileage, equipment, liabilities and assets of the surface steam railways in the United States at the close of the respective fiscal years ending in 1893:

	1893.	1892.
	Miles.	Miles.
Mileage of railroads	175,441.77	171,804.72
Second track, sidings, etc.	53,410.80	49,823.81
Total track	228,852.66	221,628.53
Steel rails in track	191,717.71	182,710.76
Iron rails in track	37,134.95	38,917.77
	No.	No.
Locomotive engines	36,012	34,626
Cars—Passenger	27,109	24,604
Baggage, mail, etc.	7,805	7,830
Freight	1,161,282	1,117,728
Total revenue cars	1,196,256	1,150,162
Liabilities.	$	$
Capital stock	5,021,576,551	4,863,119,073
Bonded debt	5,510,225,528	5,405,049,960
Unfunded debt	409,969,043	285,455,287
Current accounts	381,575,253	417,466,957
Total liabilities	11,323,286,375	10,971,091,286
Excess of assets over liabilities	406,750,426	388,469,733
Total	11,730,036,801	11,359,561,019
Assets.		
Cost of R.R. and equipment	9,573,703,214	9,293,052,143
Real estate, stocks, bonds, and other investments	1,671,841,101	1,600,493,849
Other assets	244,614,098	253,089,497
Current accounts	239,878,388	212,925,530
Total assets	11,730,036,801	11,359,561,019
	Miles.	Miles.
Miles of railroad operated	173,370.07	170,606.84
Revenue train mileage:		
Passenger	340,352,211	323,930,550
Freight	531,340,754	523,831,458
Mixed	17,751,928	17,148,455
Total	889,444,893	864,910,463
Passengers carried	628,965,973	575,769,678
Passenger mileage	15,246,711,952	13,584,343,804
Tons of freight moved	757,464,480	730,605,011
Freight mileage	90,552,087,280	84,413,197,130
	$	$
Traffic earnings—Passenger	311,978,342	293,557,476
Freight	808,494,668	794,526,500
Miscellaneous	88,168,488	80,952,864
Total	1,208,641,498	1,169,036,840
Net earnings	358,648,918	352,817,405
Receipts from other sources	111,166,837	114,428,952
Total available revenue	469,815,755	467,246,357
Payments:		
Rentals, tolls, etc.	64,038,368	62,541,445
Interest on bonds	236,755,805	229,900,292
Other interest	7,107,718	6,593,287
Dividends on stock	93,537,681	93,862,412
Miscellaneous	38,190,641	32,708,646
Total payments	440,280,213	425,615,082
Balance, surplus or deficit.	8.29,525,542	8.41,631,275

Briefly glancing over other parts of this general report, we find a statement showing the passenger traffic for the eleven years, 1883-93, inclusive. In this period the length of lines operated (106,938 miles in 1883) steadily increased until 1892, the 1892-93 period being offset by the similar falling off in mileage of 1885-86; the construction of 1883 aggregating 3,036 miles against 2,763 miles built and operated in 1892-93. In the eleven years the average receipts per passenger per mile declined from 2.422 cts. to 2.046 cts.; the average receipts per passenger fell in like manner from 66.14 cts. to 49.60 cts.; the average receipts per mile of railway quite regularly declined from $1,934 in 1883 to $1,721 in 1892, but rose to $1,799 in 1893, just as it rose from $1,645 to $1,693 during the cessation of railway building in 1885-86. The average number of passengers carried per mile of railway was 2,923 in 1883 and 3,627 in 1894. The average distance travelled per passenger in 1893 was 24.24 miles, against 27.31 miles in 1883.

A similar comparative exhibit of freight traffic for the period 1883-93 furnishes some instructive figures. The miles run by freight trains was 350,108,255 in 1883, against 531,340,754 miles in 1894, the same general mileage of railways operated being taken as for the passenger traffic. The freight carried, for the same two years, increased from 400,453,439 tons to 757,464,480 tons, and the freight movement increased in like manner from about 46,000 million miles to over 90,000 million miles. The freight rates have been very steadily decreased in this period, as is shown by the following table for the two extreme years:

	1883.	1893.
Average rec'pts, ton, per mile	1.224 cts.	0.893 cts.
Average receipts, per ton	134.72 "	106.74 "
Av. rec'pts, frght. train mile	154.09 "	152.16 "
Av. rec'pts per mile railway	$5,045	$4,663
Av. tons per mile railway	3,744 tons.	4,360 tons.
Av. ton-miles, frght. trn. mile	125.86 miles.	170.42 miles.
Av. haul per ton	110.04 "	119.55 "

The statement covering financial returns from railway investments, or the gross and net earnings, interest and dividends in these eleven years, likewise shows a very regular decline. If the two ex-

treme years are again tabulated the exhibit stands as follows:

	1883.	1893
Gross earnings	$807,112,780	$1,208,641,498
Net earnings	291,587,588	358,648,918
Total available revenue	359,942,327	469,815,755
Interest paid on bonds	171,414,258	236,755,805
Dividends paid	101,579,038	93,537,681
Earnings per mile of railway:		
Gross	7,461	6,971
Net	2,702	2,069
Percent. expenses to earnings.	68.78	70.33
[1]Percentage interest paid	....	4.39
[2]Percentage dividends paid	2.75	1.86

[1] On total bonded debt. [2] On total share capital.

The statistics of rolling stock equipment for the years 1878 to 1893, inclusive, show an increase from 16,445 locomotive engines, in 1878, to 36,486 in 1893. The passenger car list rose from 11,683 to 28,624; baggage, mail and express cars, from 4,413 to 7,895; freight cars increased in number from 423,013 to 1,161,300 in the period given. The steel rail mileage has increased from 33,680 miles in 1880 to 191,857 miles in 1893, and the iron rail mileage has fallen from 81,967 in 1880 to 37,155 miles in 1893, the percentage of steel rails in the track being 29.1% in 1880 and 83.8% in 1893.

The following useful table is one which will be found convenient for reference. It practically gives the history of railway construction in the United States from 1830 to 1893 in the annual increase of mileage:

Year.	Miles in operation.	Annual incr. of mileage.	Year.	Miles in operation.	Annual incr. of mileage.
1830	23	..	1862	32,120	834
1831	95	72	1863	33,170	1,050
1832	229	134	1864	33,908	738
1833	380	151	1865	35,085	1,177
1834	633	253	1866	36,801	1,716
1835	1,098	465	1867	39,250	2,249
1836	1,273	175	1868	42,229	2,979
1837	1,497	224	1869	46,844	4,615
1838	1,913	416	1870	52,922	6,078
1839	2,302	389	1871	60,293	7,379
1840	2,818	516	1872	66,171	5,878
1841	3,535	717	1873	70,268	4,097
1842	4,026	491	1874	72,385	2,117
1843	4,185	159	1875	74,096	1,711
1844	4,377	192	1876	76,808	2,712
1845	4,633	256	1877	79,088	2,280
1846	4,930	297	1878	81,767	2,679
1847	5,598	668	1879	86,584	4,817
1848	5,996	398	1880	93,296	6,712
1849	7,365	1,369	1881	103,143	9,847
1850	9,021	1,656	1882	114,712	11,569
1851	10,982	1,961	1883	121,455	6,743
1852	12,908	1,926	1884	125,379	3,924
1853	15,360	2,452	1885	128,361	2,982
1854	16,720	1,360	1886	136,379	8,018
1855	18,374	1,654	1887	149,257	12,878
1856	22,016	3,642	1888	156,169	6,912
1857	24,503	2,487	1889	161,353	5,184
1858	26,908	2,405	1890	166,706	5,353
1859	28,789	1,821	1891	170,795	4,089
1860	30,626	1,837	1892	175,204	4,409
1861	31,286	660	1893	177,753	2,549

DIAGRAM FOR CALCULATING LENGTH OF COVER PLATES FOR PLATE GIRDERS.

By T. Kennard Thomson, Chief Engineer Dominion Bridge Co.

The writer, having had occasion to prepare for the shop from time to time plate girders for which the cover plates had been designed much too short, has devised the accompanying diagram for calculating the length of cover plates easily and quickly. This diagram was originally prepared for use in the engineering department of the bridge works with which the writer is connected, and is now published with the hope that it may be found useful by others and may tend to reduce the frequency of the errors noted above. As is well known, the bending moment at any point of a uniformly loaded girder is measured by the ordinate through that point of a parabola whose axis is the vertical through the center of the girder and whose base is the horizontal line between the points of support. The diagram is simply a series of such parabolas from which the length of cover plates can be easily found. For example, suppose the section at the center is 38 sq. in. and the cover plate is 16 ins. × ½ in. = 8 sq. in. The difference is 38 — 8 = 30 sq. ins. On the diagram the horizontal line through 30 intersects the parabola through 38 at 0.46 from the end. If, then, the span of the girder is 60 ft., the length of cover plate will be 60 × 0.46 + 2 ft. for rivets = 29 ft.

The Mexican government survey of the volcano Popocatapetl is making good progress. The altitude is 19,643 Spanish feet, and the circumference of the crater is 14,000 ft. The location of a 10-mile wire ropeway is being studied, with the view of connecting the sulphur mines in the crater with the base of the mountain. The Spanish "pie," or foot, in use in Mexico, is equivalent to 11.128 ins.

SPECIFICATIONS FOR ELECTRIC STREET LIGHTING PLANT FOR TORONTO.

The city of Toronto, Ont., is to receive bids until Sept. 1 for an electric street lighting plant on the arc system. Specifications for the plant have been drawn by Mr. E. H. Keating, M. Am. Soc. C. E., City Engineer of Toronto, and as few specifications for so large an electrical plant have ever been published, we print these nearly in full below, omitting only the general clauses of merely local interest:

Engines.

There are to be furnished, erected complete and in perfect working order, three triple expansion or compound vertical or horizontal condensing engines especially adapted for electric light purposes, of extra heavy construction throughout, and rated at 500-HP. each when cutting off at one-fourth stroke with initial pressure on high pressure cylinder of 140 lbs. per sq. in. above atmosphere, and a vacuum of 25 ins. on low pressure cylinder.

The speed of engines shall not be less than 75 or more than 90 revs. per minute where Corliss valve gear is used, nor more than 130 revs. where piston or slide valves are used.

Each engine must be guaranteed to run under normal conditions as above, and under all possible changes of load with an absolute regulation of not over 2½% variation in speed and not to exceed a steam consumption of 15 lbs. of dry steam per I. HP. hour when working at rated capacity. Piston speed must not be more than 750 ft. per minute.

Engines must be of best quality and workmanship throughout with latest improvements of valve gear and lubrication. All parts must be absolutely interchangeable and moving parts perfectly balanced. Valves and packing must be free from leakage. Each engine must be provided with extra heavy flywheel, not more than 20 ft. in diameter and 48-in. face crowned in center for single belt and constructed in at least four sections and turned absolutely true on face and rim with extra heavy key seat and hub.

Engines must operate noiselessly and without pounding or vibration where set on suitable foundations which will be provided by the corporation and built to the satisfaction of the engine contractor, who shall furnish plans of foundation with tender.

Each engine must be designed and piped so that any of the cylinders may be worked independently. Valves to be designed so that each engine may be operated under any condition of load either condensing or non-condensing. All material used must be specially adapted to strains, stresses and variations of temperature to which it may be subjected.

Each engine must be provided with and fitted, when and where necessary, by the contractor, with the following appliances: (1) All necessary foundation bolts and anchor plates, etc.; (2) Complete set of sight feed lubricators, including one of one quart capacity for each cylinder, together with at least one auxiliary hand pump for same; (3) Complete set of relief or snifting valves; (4) At least three hand feed oil cans of different capacity with suitable tray and stand; (5) All necessary drip or floor pans and connections for oil and water leakage; (6) One steam gage of approved design for each cylinder; (7) One full set of wrenches (case hardened), spanners, hammers or special tools that may be required for ordinary adjustments; (8) One set of indicator apparatus including reducing gear, pipes, stop-cocks, etc., that may be left permanently on engine; (9) One automatic auxiliary safety throttle emergency governor of approved design to be attached to inlet of high pressure cylinder to prevent running away of engine; (10) One throttle valve of approved design.

Each proposal must be accompanied with complete specifications of proposed engines, together with working drawings and itemized list of proposed apparatus complete, and if possible, a photograph of same.

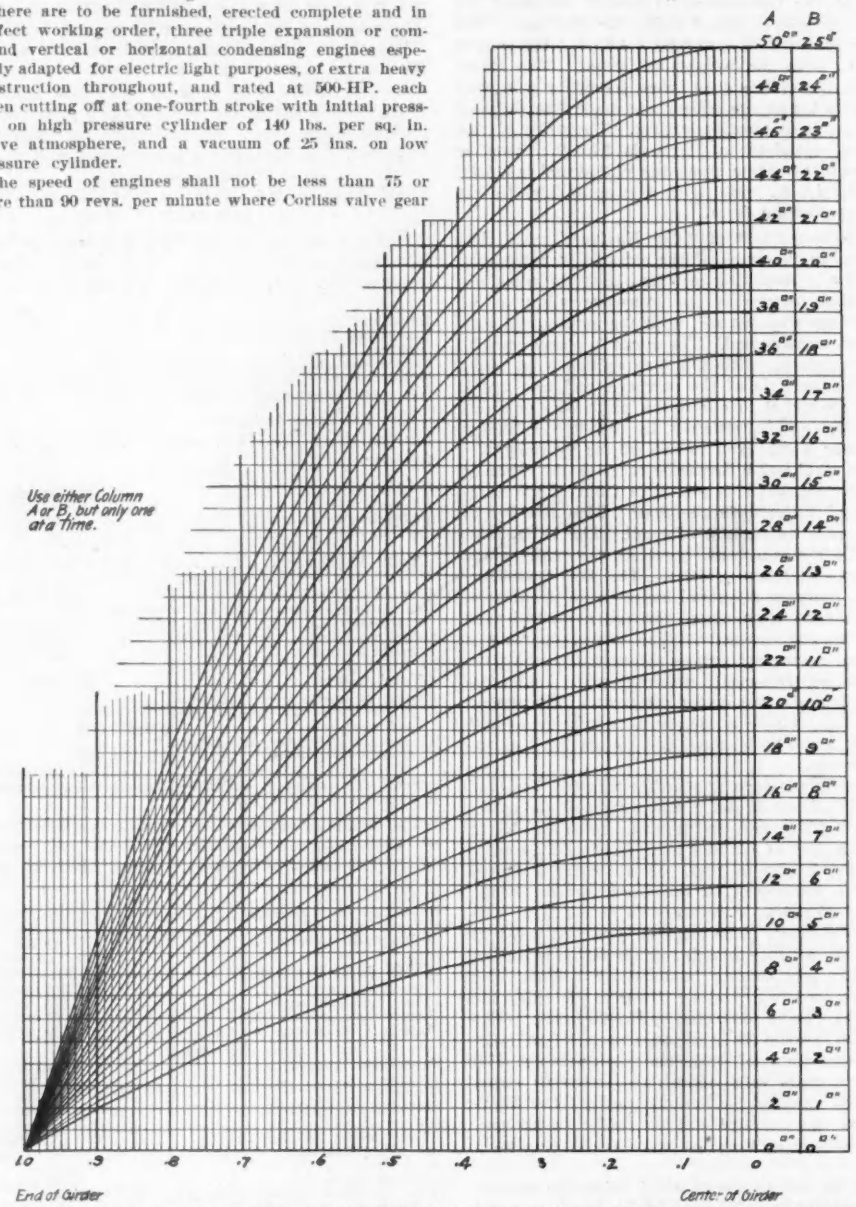


DIAGRAM FOR DETERMINING THE LENGTH OF COVER PLATES FOR PLATE GIRDERS.
T. Kennard Thomson, Chief Engineer Dominion Bridge Co.

In each tender submitted the following list must be copied and filled in, viz.: No. of engines, 3; rated HP., at ¼ stroke at 140 lbs. steam, condensing; sizes of cylinders; diameters of steam, exhaust and receiver pipes; if cylinders are steam jacketed; if receiver between cylinders; details of construction and dimensions of same; diameter, weight and face of flywheel; guaranteed regulation; steam consumption per horse-power per hour at rated capacity; arrangement of governor, whether attached to valve gear of one or more cylinders.

Boilers.

Tenders will be received for two types of boilers, viz.: (1) so-called water-tube, and (2) so-called marine internally fired type. All boilers to be specially adapted for at least 180 lbs. per sq. in. absolute working pressure.

No. 1. Water-Tube Boilers.—Contractors shall furnish, erect, complete and deliver in perfect working order, including setting in the power house of the city of Toronto, on foundations provided by the corporation, seven water tube boilers of 150 HP. each rated capacity on a basis of 30 lbs. of evaporation at 70 lbs. steam pressure, with feed water 100° F., approximating 250 HP. at the cylinders of compound or triple expansion medium speed condensing engines.

Boilers must be submitted to a factory test satisfactory to the engineer, of 270 lbs. per sq. in. hydrostatic pressure. Tubes must be No. 1, lap welded, free from all defects. Special attention must be given to the method of securing same on headers, no screw joints being allowed. All joints must be guaranteed free from leakage for a period of six months after starting under ordinary use. Headers must be of mild steel of approved quality. Drums must be of mild steel, Dalzell brand, or other quality as good, with a tensile strength of not less than 60,000 lbs. per sq. in. Special arrangements must be made for conveniently cleaning and washing boilers, removing tubes and ordinary repairs. Boilers must be given at least two coats of black asphalt varnish, applied hot before leaving the factory, and at least one coat after the erection on the blocking at the power house.

Water tube boilers must be set in masonry in the very best manner, using where usual or required No. 1 fire brick laid in fire clay. All other bricks to be of best hard kiln run laid with No. 1 lime mortar. Hard bricks of uniform color to be used on outside of all walls. Contractors must be responsible for any cracks in setting that may develop with 90 days of date of use, and must rebuild or repair the same as directed. Ash pits must be cemented water-tight. All material must be such as is especially adapted to strains, stresses and variations of temperature to which it may be subjected. The corporation will do all necessary excavation or filling for foundations, and build same according to plans furnished by contractor.

No. 2. Internally Fired Marine Boilers.—Contractors shall furnish, erect, complete and deliver in perfect working order in the power house of the city of Toronto, on foundations as provided by the corporation, five internally fired marine boilers, with two corrugated furnaces each.

Each boiler shall have a rated capacity of 250 HP. on a basis of 30 lbs. evaporation at 70 lbs. pressure, feed water 100° F., approximating 350 HP. at the cylinders of medium speed, compound or triple expansion condensing engines.

Boilers to be absolutely safe at a working pressure of 180 lbs. per sq. in., tested before leaving the factory, to the satisfaction of the engineer, with a hydrostatic pressure of 270 lbs. per sq. in. Plates must be of mild open hearth steel of Dalzell brand, or other quality equally as good, and must have a tensile strength of not less than 60,000 lbs. per sq. in. Tubes must be of No. 1 lap, welded and secured to heads in an approved manner; no liners or bushings will be allowed.

All material shall be such as is especially adapted to strains, stresses and variations of temperature to which it may be subjected. The corporation to do all necessary excavation or filling for foundations, and to build same according to plans furnished by contractor.

Boilers must be covered after erection with approved heat non-conducting material. Boilers must be given at least two coats of black asphalt varnish, applied hot before leaving the factory, and at least one coat after erection on blocking at the power house.

General Boiler Specifications.—Each boiler must be provided and erected with the following attachments: All necessary brackets, plates, belts, stays, anchor and binding rods, man and handholes, steam and blow-off connections, stop and safety valves, extra large pressure gage, water column, gage cocks, drips, besides one set of firing and cleaning tools complete, together with smoke flue connection. One damper regulator must be supplied and erected in working order for the entire battery. One set of spare grate bars, for one boiler, must be furnished.

Boilers must be fitted with all necessary or usual appliances, whether herein specified or not, to place same in complete working condition, satisfactory to the engineer. When complete and in operation, and when the engineer shall direct, the contractor must conduct an official test, to demonstrate to the engineer's satisfaction the guarantee of capacity, evaporation and efficiency. All boilers must be hydraulic riveted; holes must be punched true to center, and no drifting will be allowed.

After completion, the boilers must be inspected and approved, both before and after starting, by the Boiler Inspection & Insurance Co., of Canada. Contractors must carry the cost of the same for one year.

Bidders must furnish, with tender, a detailed working drawing of the proposed boilers, settings and foundations, together with photograph of same, if possible, and an itemized list of all appliances and material they propose to furnish, with full and complete description of same.

Bidders must copy and fill out in detail the following list, which must accompany their tender:

(1) Number of boilers to be supplied; (2) Type of boiler; (3) Rated horse-power each, Centennial standard; (4) Floor space and general dimensions; (5) Heating surface, each boiler; (6) Guaranteed evaporation; (7) Nature of grate, whether stationary or rocking; (8) Grate area, sq. ft. per HP.; (9) Number of drums, if any, and dimension of same; (10) Diameter and length of tubes; (11) Thickness of shell and heads.

Condensers.

The contractor shall furnish, deliver, erect and complete on foundations prepared by the city, and satisfactory to the engineer, three independent jet condensers (one for each engine) of ample capacity that a constant and sufficient vacuum may be maintained with engines working to limit of cut-off.

All plates, bolts, nuts, etc., necessary to secure the same to be furnished by the contractor, who shall give a detailed and plain description, together with working drawings of all apparatus, and distinctly specify dimensions, approximate horse-power, diameter and stroke of air pump, valve area, diameter of suction, overflow, exhaust, diameter and stroke of steam pump, and diameter and stroke of feed and exhaust for same. They shall state and guarantee the temperatures of water discharge and vacuum maintained when engines are working at rated capacity (500 HP. each).

The condensers shall work smoothly and without noise or vibration. They shall each be equipped with one approved vacuum gage, located where the engineer may direct, and connected to air pumps. The contractor shall furnish with tender a detail plan of foundations required.

The contractor shall give condensers one coat of paint after they are connected and in running order.

Boiler Feed Pumps.

The contractor shall furnish, deliver, erect and complete on foundations furnished by the city, and built in accordance with plans which contractors shall furnish with tender, three heavy-pressure boiler feed pumps, with all necessary plates, bolts, nuts, etc., and secure the same to the foundations.

Pumps are to be constructed of the best material and specially designed to work against a pressure of 180 lbs. Water cylinders shall be provided with removable liners of brass or gun metal, water piston and valves to be arranged for pumping hot water.

Pumps shall run smoothly without pound or vibration when operating against 180 lbs. pressure at a piston speed of not more than 100 ft. per minute, and shall have a capacity of at least 125 gallons per minute each, under these conditions.

The contractor shall give a detailed and plain description of the pumps and an itemized list of the material he proposes to furnish, together with definite and full plans and drawings, giving dimensions, foundations, etc., complete, and dimensions of all piping required, and the length of stroke and diameter of cylinders.

Provision must be made on pumps for connection of waste delivery, starting and charging pipes, etc.

Economizer.

The contractor shall furnish, deliver, erect and complete on foundation furnished by the city and built to the contractor's satisfaction, one economizer of standard manufacture, and of such dimensions as required by the boilers specified. All necessary plates, bolts, nuts, etc., for securing the economizer to the foundation must be furnished by the contractor. A guarantee of temperature of feed water shall be given under certain conditions, which the contractor shall specify, to conform as correctly as possible to the future operation of plant. The contractor shall state the size of opening into the stack, number and diameter of pipes, and give a plain and detailed description of the apparatus, together with complete drawings and dimensions of same.

Electrical Work.

The contractor shall furnish, deliver and erect, complete and in good working order, all the required dynamos on foundations furnished by the corporation, each to operate 75 to 100 lamps upon the circuit necessary, and representing a total operating capacity of 1,500 arc lamps, each lamp requiring from 9½ to 10 amperes, and 45 to 50 volts. The contractor must furnish detailed description of dynamos proposed, with photograph and working drawings, giving dimensions thereof, etc. The dynamos shall be provided with an efficient automatic regulator of the latest and most efficient pattern, that will make the proper adjustments for all changes of load from no load to full load, the adjustments to be made in such a way as not to injure or endanger any part of the dynamos, appliances or lamps, nor to cause any perceptible change in the lamps remaining in operation.

Dynamos must be capable of a commercial efficiency under full load of not less than 85%, and shall be capable of operating, under full or any other portion of full load, for 20 consecutive hours without an increase in temperature of any part, especially the armature, fields and commutator, of more than 70° above the temperature of the surrounding atmosphere, or decreasing the efficiency of operation. They shall have an insulative resistance of not less than one megohm between all parts insulated from each other, and shall be provided with the most approved modern self-oiling devices.

The armature shall be balanced both electrically and mechanically, so that there will be no tendency to spring the shaft or to draw the armature towards either bearing, so as to cause excessive friction and heating or vibration, and special attention shall be given the insulation, protection and separation of contacts, binding posts and bared surfaces having extreme differences of potential, in order to minimize the danger of accidental shocks, crosses or grounds under normal conditions of operation.

The dynamos shall be so constructed and automatically regulated that the power will be automatically proportioned to the number and candle-power of the lamps burning at any time. The dynamos must be securely fastened to the top timber work of foundation, or to the foundations through the timber work, both timber work and base frame being secured in such a manner as to prevent lateral motion in either direction, and to give an even and horizontal bearing surface at every point.

There shall be provided for each dynamo, in addition to the automatic regulator required, one wall controller, controlling the automatic regulator, two lightning arresters, one ampere meter, one lamp indicator, one brush jig for trimming the brushes, one spare set of brushes, one insulating base frame, provided with suitable apparatus for shifting the position of the dynamo to alter the belt tension; one main switch for the general installation, one standard voltmeter, two testing magneto bells capable of ringing through 50,000 ohms. All of these instruments must be of the very latest and best type, approved of by the engineer, and must be fastened to switchboard and wall of building, as directed by the engineer. Detailed description, together with drawing of all parts, must be submitted with proposal.

The contractor shall furnish and put in place, complete in all respects, a switchboard, to be made of slate of marble slabs, supported on a frame of angle iron. The board shall be set so as to enable access from the rear for inspectors, and shall be neatly finished in all details. On the switchboard will be located the wall controllers, ammeters, lamp indicators, and one 20-circuit arc plug switchboard, provided with the necessary sockets, plugs, main and transfer cables and testing connections. It shall be so arranged and marked that any circuit or series of circuits may be at once connected or disconnected from any dynamo with the least possible danger of short circuits or errors. Sockets shall be so designed that it will be practically impossible to short circuit, ground, or receive a shock from them. All connections with the dynamo leads shall be easily accessible. All wires used in making connections shall have approved high grade rubber insulation. All blocks and plugs shall have well-insulated wooden handles, and the cable shall be covered with an extra double silk-braided hose, or equivalent, as an extra precaution.

Dynamos shall be connected with the instruments on switchboard by means of lead-covered cables running through insulated brass-covered conduits, placed in or under the floor of the dynamo room, said cables to consist of No. 6 B. & S. gage, copper-stranded conductor, thoroughly and efficiently rubber insulated. In no case shall insulated wire be carried in such proximity to heated or moist surfaces, vapors, or air or metallic substances as to endanger their insulation.

When the entire plant shall be ready for operation, the dynamos shall be run in conjunction with the other installations, mechanical, etc., for the period herein before provided by competent experts furnished by the contractors. The contractor shall give all necessary detailed instructions free of charge to the city engineer and engineer who will have charge of the plant after completion, for the proper care, maintenance and operation of the dynamos and switchboard, such instructions to be given during the trial period referred to above, and subsequently if so required.

The contractor will be required to wire the plant with No. 6 B. &. S. gage copper wire, having the same in-

sulation as the other interior wire. The wiring shall be done in a neat and workmanlike manner, as directed by and satisfactory to the city engineer or superintendent. Dynamos shall be duplicates in every part, so that any part of any machine that may at the time of installation or thereafter be found not duplicated, shall be replaced by the contractor free of charge. The engineer and his representatives shall have authority to visit the factory of the contractor and inspect the machines whilst in course of construction. The contractor for the dynamos will also be required to supply 50 sets of dynamo brushes, 10 extra commutators, 3 barrels of dynamo oil, 2 first quality oil filters, capacity 20 gallons each; 2 spare armatures, and 1 set of field coils for one machine.

Arc Lamps.

The contractor shall furnish and erect, complete in all respects, on the mast arms to be provided, 1,300 double carbon simple mechanism, 14-hour arc lamps of 2,000 nominal c. p., each lamp requiring not less than 9 or more than 10 amperes, and from 45 to 50 volts for operation, together with all necessary connections. Each lamp shall be provided with switch, by which it may be cut in or out of circuit, and shall be regular in its feeding action, shall be free from hissing, flickering or flaming when provided with proper carbons. They shall contain an efficient device which shall automatically cut out a lamp that is from any reason defective, without interfering with the operation of the remaining lamps in circuit, and shall be simple, strong and durable in their mechanical operation. Contractors are required, when submitting their tenders, to give a clear and detailed description of the working and mechanism of the lamps they propose furnishing. They shall also provide for all lamp globes of such kind and color as the city engineer shall direct. All lamps giving out or in any way proving defective during the period of one year of continuous operation, under normal and proper use, shall be replaced without extra charge. The corporation will retain 5% of the contract amount for the said period for the fulfillment of this condition.

On the completion of the contract of the electrical part of the work, an insurance certificate by the Canadian Board of Fire Underwriters shall be furnished free of charge by the contractors, stating that all insurance rules and regulations have been complied with. The contractor for the lamps will also be required to furnish and erect where directed 1,300 waterproof hoods, complete with hanger boards to be arranged for suspension at the end of mast arms or brackets attached to poles or posts, so as to thoroughly insulate from the heads of attachments.

The contractor for the lamps will also supply the following:

Ten thousand sets of carbons, a set being the carbonds required for one filling of an arc lamp; 2,000 globes for arc lamps; 200 feed magnets for arc lamps; 200 upper carbon holders; 200 lower carbon holders; 200 carbon feed rods.

Pole Line.

Contractors for these works shall furnish, erect and complete all necessary or required poles, wires, mast arms and fittings, as well as all requisite materials, accessories, labor and carriage in connection therewith as may be called for by the engineer for the complete construction and operation of the entire electric light system outside of the power house, and exclusive of the lamps only.

The contractors shall secure all right of way, permits, etc., from the proper authorities, for the erection and guying of poles, stringing of wires, etc., and shall make all necessary arrangements with companies already having pole lines on any of the streets, lanes or private property, for crossing, raising, lowering, or otherwise removing or altering existing wires or other structures, matter or work, and for moving or changing their poles and cross-arms. They shall also arrange with the owners or other interested parties for all necessary trimming of trees, and furnish all proper facilities for the uninterrupted continuance of the work to its completion, and shall be entirely responsible for all damage they or any of them or their agents or workmen may do or occasion.

Poles must be sound, white cedar, perfectly straight, shaved and planed smooth, and clean and free from all imperfections. They shall not be less than 7 ins. in diameter at the top or small end. No pole shall be set less than 5 ft. in the ground, and shall be solidly tamped, set, maintained, perfectly plumb, and where subject to a strain tending to draw them out of a vertical position, they shall be properly braced or guyed, for which contractor shall make all necessary provision, as no stubs or guy posts will be allowed on the streets. Poles shall be set about 125 ft. apart where and if required, and in such locations as may be specified or marked by the city engineer, or must be approved of by him. Poles shall be from 40 to 55 ft. in length, as called for hereafter. Lamp poles and corner poles shall be set in concrete, composed of Portland cement mortar, mixed in the proportion of one part of cement to two parts clean, sharp sand, and three parts clean lake gravel or broken stone; concrete must be at least 7 ins. in thickness around the pole, and for its full depth. Where poles are set in concrete, the top finish must be left flush and smooth with existing sidewalk or pavement. All openings cut for poles must be neatly and properly made and finished at the surface, as directed by the engineer, and stone and granolithic pavements must be finished to correspond with the best class of similar work in the city.

After erection all poles shall receive two coats of paint, of such quality and colors as the city engineer may direct.

55-ft. poles at least 10 ins. dia. at top, set 8 ft. in ground
45 " " 9 " " 7 "
40 " " 7 " " 6 "

The corporation reserves the right to negotiate with any company or companies now having poles upon the streets, lanes, etc., with the view to utilizing the same for the purposes of placing the wires herein required thereupon, and wherever this privilege is acquired, the contractor will not be required to furnish new poles, but must provide all necessary cross-arms, pins, insulators, fittings and appliances, and must string the wires thereto; but where it may be necessary to lengthen any existing iron pole, the necessary lengthening piece will be furnished and put in place by the corporation.

Cross-arms shall be of white pine, 4 × 3¾ ins., thoroughly seasoned, sound, free from knots, checks, or any other defects, and shall be of approved design, with bevelled edges, and shall be painted with two coats of paint, of such quality and color as the city engineer may direct. The vertical distance between cross-arms shall not be less than 20 ins. The distance between the pole pins shall not be less than 22 ins. At all corners two sets of double cross-arms shall be used, placed at the proper angle, and securely bolted to each other. Where cross-arms are attached to iron poles, a specially strong staple fastening must be provided.

No cross-arm of more than six pins will be allowed. No side blocks will be allowed. Lag or coach screws must be 8 × 9-16 ins., at least two in each cross-arm, and provided with necessary iron washers.

Pins shall be of clear, selected wood, of locust or oak, and shall fit tightly into the cross-arms. All pins to be 1½ ins. in diameter in the cross-arm, into which they shall be securely and tightly driven the full depth of the cross-arm, and shall be dipped in boiling linseed oil before being driven.

Glass insulators of the deep groove, petticoat pattern shall be used, and shall be guaranteed to stand high potential without any leak, and provided with a groove suitable for the wire they are to hold.

The wire used for all circuits shall be of No. 6, B. & S. gage, copper, having a conductivity of at least 98%, with triple-braided weather-proof insulation; samples of wire to be submitted with the tenders. All wire shall be handled so as to avoid kinking, and not be dragged along the ground, over cross-arms, or through the streets in such a way as to endanger or injure the insulation, and shall not be allowed to sag unduly between supports; proper allowance being made for contraction and expansion with changes of temperature. All wires from mast arm poles to lamps shall be of insulated stranded rubber covered wire, of not less than 49 strands. All tie wires must have an insulation equal to that of the conducting wire. Care must be taken that conducting wires are not placed in such a position that it would be easy for water or any liquid to form cross-connections between them, and they should not approach each other nearer than 20 ins. between spans. All wires must be installed so as not to come in contact with any substance other than air and their proper insulating supports. All necessary precautions shall be taken in passing through trees, crossing other lines, and turning corners, and wherever else necessary. The contractor agrees to indemnify and hold the city harmless from accidents or damage which may happen from this or any other causes. Wherever wires cross streets or thoroughfares, all pins must be protected by iron guards at end of cross-arms to prevent wires from falling clear of pole.

All joints must be so made that a perfectly secure and unvarying connection, fully equal to the cross-section of the conducting wire, will be secured, and they shall be carefully soldered. All joints must be securely wrapped with at least five layers or ply of tape approved by the city engineer, and insulation made equal to the balance of the wire.

The line contractor shall bring all outside circuits to switchboard of power house, and provide all necessary structures, fixtures, etc., for same, subject to the conditions of this specification and the engineer's approval.

For every 20 lamps throughout all the circuits the contractor will be required to furnish and place in position on pole, one Wurtz, or equally good lightning arrester, of latest and approved make, properly connected to line and ground in a permanent and substantial manner.

Iron or steel mast arms, of approved pattern, with windlass attached, complete, shall be used and properly set and fitted to each lamp pole. The length of arm required will vary from 12 to 18 ft., properly and securely trussed, side trusses preferred, and shall be so constructed that when the lamp is lowered for trimming the bottom of lamp shall not be more than 4 ft. from the ground. All fittings of mast arms, windlass, etc., must be as far as possible galvanized iron or steel, or non-corrosive metal. Full description and drawings to accompany tender. The windlass for lowering and raising lamps shall be of approved pattern, set where and as directed, and shall be self-locking. Mast arms and windlass shall be painted with two coats of paint of quality and color as ordered.

The contractor shall also furnish complete equipment, consisting of all cable, cord, reels, etc., necessary for the erection of lamps in the centers of the streets. Cables are to be of flexible steel wire, not less than ¼ in. diameter, and of ample strength to safely sustain a weight of 1,500 lbs.

The following are the approximate number of the different lengths of poles and the number of miles of wire required, but the contractor must distinctly understand that these quantities are not guaranteed, and may be increased or diminished by the engineer as circumstances may require. The contractor will only be paid for the actual number of poles and mast arms ordered in writing by the engineer and for the mileage of wire actually necessary:

55-ft. wooden poles	2,000
45-ft. "	2,000
40-ft. "	2,000
Miles of wire required	220
12-ft. mast arms	400
15-ft. "	400
18-ft. "	400

Separate tenders for different parts of the work herein called for are invited, and will be considered provided the party tendering includes in his tender for any one class of work everything necessary thereto, and all that is required, called for or implied under that item.

Constant Potential System (Alternative Bids).—Makers of constant potential arc light machines are invited to bid on their apparatus of capacity equivalent to direct current apparatus called for in these specifications. They are required to examine carefully the said specifications in order that they may understand what efficiencies and results are expected. They are further required to examine for themselves on the ground the local conditions of lighting the streets of the city of Toronto, and to furnish with their tender a plat or plan of a representative district, showing the manner in which their system would be arranged to admit of a proper comparison of bids, together with a full description. Tenders for constant potential machines must include direct coupled generators and vertical marine type compound or triple expansion condensing engines, and must state the reserve plant they propose to furnish. Bidders on constant potential systems are required to furnish their specifications from plan of the city, showing proposed approximate positions of lights, which will be furnished by the city engineer.

All electrical and mechanical work, both inside and outside construction, shall be subject to the approval and acceptance of the Canadian Board of Fire Underwriters, the contractors to bear the expense of said inspection in all cases.

PERSONALS.

Mr. Arthur Rotch, a prominent Boston architect, died at Beverly, Mass., Aug. 15.

Mr. W. R. Crumpton has resigned as General Manager of the Baltimore & Lehigh R. R.

Mr. John W. Collins has been appointed Engineer-in-Chief of the U. S. Revenue Cutter Service.

Mr. Lewis Williams, formerly General Superintendent of the Nickel Plate system, died recently at Conneaut, O.

Mr. J. M. Warner has been appointed Superintendent of the Chicago & Western Indiana R. R. and the Belt Ry. of Chicago.

Prof. C. Leo Mees has been appointed Acting President of the Rose Polytechnic Institute, of Terre Haute, Ind., vice Dr. H. T. Eddy, resigned.

Mr. W. L. Webb, a railway contractor of Lemont, Ill., is reported to have committed suicide at Birmingham, Ala., on Aug. 9, owing to financial troubles.

Mr. R. Harding, of Wichita, has resigned as Superintendent of the Missouri Pacific Ry. to accept the position of Superintendent of the Dakota lines of the Great Northern Ry.

Mr. A. G. Menocal, Chief Engineer of the Navy, has received a 45-days' leave of absence to go to London. It is reported that he goes in the interest of the Nicaragua Canal Reorganization Committee.

Mr. Aldace F. Walker, formerly one of the Interstate Commerce Commissioners, has been appointed a Receiver of the Atchison, Topeka & Santa Fe R. R., to succeed President J. W. Reinhart, resigned. The appointment was made by Judge Caldwell, of the U. S. Circuit Court.

Mr. Thomas Pettigrew has been elected Chief Engineer of the West Virginia, Ohio & Western R. R., which

WEATHER TABLE FOR JULY, 1894. (Furnished to Engineering News by the Department of Agriculture.)

	Stations.	Temperature. (Deg. Fahr.)				Wind.			Precipitation—rain or melted snow—inches.		
						Velocity in miles per hour.		Direction at time of max. velocity.			
		Average.	Max.	Min.	Range.	Average.	Max.		Total.	Heaviest in 24 hours.	No. of rainy days.
Northern Cities.	Northfield, Vt.	67.2	93	42	51	7.0	28	S	1.64	.40	13
	Portland, Me.	69.8	97	53	44	5.9	22	E	2.96	1.37	11
	New York, N. Y.	76.1	96	58	38	8.5	31	NW	2.89	1.69	10
	Pittsburg, Pa.	76.3	97	49	48	5.5	30	NW	1.16	.56	12
	Chicago, Ill.	73.4	96	54	42	14.8	50	SW	.60	.53	2
	Omaha, Neb.	77.4	106	59	47	9.2	28	S	.61	.35	5
	St. Paul, Minn.	75.8	100	53	47	7.3	27	W	.13	.05	4
	Duluth, Minn.	68.6	94	51	43	6.5	25	NE	.92	.74	8
	Bismarck, N. Dak.	74.2	101	47	54	8.5	36	S	.30	.25	3
	Average	73.2	97.8	51.8	46	8.1	30.8		1.24	.66	7.6
Southern Cities	Washington, D. C.	77.9	97	54	43	5.4	26	NW	2.14	.84	9
	Louisville, Ky.	78.1	96	57	39	6.1	23	SW	2.41	1.59	7
	St. Louis, Mo.	79.2	98	61	37	8.9	40	NW	1.35	.89	8
	Savannah, Ga.	79.2	94	66	28	7.2	28	NE	13.18	4.21	23
	Kansas City, Mo.	76.8	99	61	38	7.0	35	NW	4.35	2.27	5
	Jacksonville, Fla.	80.5	93	68	25	7.8	42	SW	7.10	2.09	21
	Chattanooga, Tenn.	76.6	94	59	35	5.0	36	NW	3.66	.75	18
	New Orleans, La.	79.1	99	67	32	5.7	42	E	11.51	1.89	21
	Memphis, Tenn.	78.4	99	62	37	4.9	30	NW	3.27	1.54	8
	Palestine, Tex.	80.8	105	63	40	4.9	25	NE	2.76	2.41	7
	Average	78.7	97.2	61.8	35.4	62.9	32.7		5.17	18.5	12.7
Western Cities.	Helena, Mont.	69.0	94	46	48	7.4	36	W	.32	.13	6
	Port Angeles, Wash.	56.6	86	43	43	6.6	24	W	.21	.10	4
	San Francisco, Cal.	56.4	76	48	28	15.1	40	SW	Trace	Trace	0
	Salt Lake City, Utah	74.6	96	53	43	5.6	38	W	.82	.50	4
	Santa Fe, N. Mex.	68.8	84	49	35	6.7	42	SW	2.17	1.41	12
	Denver, Colo.	71.6	96	53	43	6.5	36	SW	2.11	1.16	11
	Yuma, Ariz.	91.2	113	72	41	7.1	30	SE	.36	.36	1
	Average	69.7	92.1	52.0	40.1	7.8	35.1		.86	.52	5.4

was recently incorporated to build a 40-mile line from Belington, the West Virginia terminus of the West Virginia Central & Pittsburg, through the coal fields to Martinsville, W. Va.

Prof. Wm. Henry Cusack died at his home in Poughkeepsie, N. Y., Aug. 15. He was 63 years old, and was born in Brookline, Mass. He was at one time State Architect of Tennessee, and was one of the six architects whose plans for the new City Hall in New York are under consideration.

Mr. Jeremiah Prescott, formerly Superintendent of what is now the Eastern division of the Boston & Maine R. R., died at Arlington, Mass., Aug. 17. Mr. Prescott began as a conductor in 1844, and from 1854 to 1874 he was superintendent of the above road. He was afterwards connected with the Hoosac tunnel.

NEW PUBLICATIONS.

DISEASES OF THE AIR-BRAKE SYSTEM: Their Causes, Symptoms and Cure. By Paul Synnestvedt, Chicago; The W. F. Hall Printing Co., 21 Plymouth Place. 12mo; cloth; pp. 114; 40 illustrations; $1.

This book treats in a clear and practical way the maintenance and repair of the various parts of the air-brake system, describing the various troubles experienced, their causes and the means of remedying them. In his preface the author says:

Always use your reason first and your hands afterward. Treat your case just as a doctor does his patient; first finding out the nature and cause of the disease, and then prescribing and applying the remedy.

In regard to the main drum it is specially noted that this should be as large as possible, placed low down so as to collect any condensation from the pipes, and it should be frequently drained. Many of the accidents for which the daily papers assign the reason that "the air-brakes failed to work," the author thinks may be attributed to the spring on the handle of the engineer's valve becoming bent or loose, so that when apparently in running position the parts may actually be on lap, and if left in this position the train-pipe pressure may be so reduced that it will be of little account for an emergency stop. While the complaint that "the triple-valve sticks" is one of the most common of those made by the trainmen and enginemen, the author considers that in nine cases out of ten the valve is not to blame, but merely indicates that something is wrong elsewhere, for the valves must be in very bad shape indeed if they will not work at all. The importance of the foundation brakes (or apparatus for transferring the braking power from the brake cylinders to the shoes) is not overlooked, and it is pointed out that the efficiency of the brakes depends largely upon the condition of this part of the apparatus. The book is well printed and well illustrated, and deals with both the Westinghouse and New York brakes.

SOCIETY PROCEEDINGS.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.—This youngest of the National engineering societies held its first regular meeting in Brooklyn, Aug. 20, 21, and 22. About 45 members were in attendance, and a valuable series of papers was presented. The greatest interest was manifested and the discussions on the papers were animated and well sustained. We print on another page an abstract of the address made by the President, Prof. De Volson Wood, of Stevens Institute, at the opening session, and hope to give in later issues abstracts of some of the papers presented of greatest general interest. The list of papers was as follows: "Entrance Requirements Common to all Engineering Schools," F. O. Marvin, Kansas State University; "Engineering Education and the State University," W. M. S. Aldrich, University of West Virginia; "Text-Books Considered as Such and Not as Works of Reference," C. H. Benjamin, Case School of Applied Sciences; "Graduate and Post-Graduate Engineering Degrees," Palmer C. Ricketts, Rensselaer Polytechnic Institute; Geo. F. Swain, Mass. Inst. Technology; Robt. H. Thurston, Director Sibley College, Cornell University; "Teachers and Text-Books in Mathematics for Engineering Students," Mansfield Merriman, Lehigh University; "Teaching Engineering Specifications and the Law of Contracts," J. B. Johnson, Washington University; "Teaching Mechanical Drawing and Lettering in Engineering Schools," J. J. Flather, Purdue University; "Early Instruction in Physics and Mechanics," C. M. Woodward, Dean of School of Engineering, Washington University; "Some German Schools of Engineering," Storm Bull, University of Wisconsin; "The Organization and Conduct of Engineering Laboratories and the Equipment of the Laboratories at the Mass. Inst. Tech.," Gaetano Lanza; "Electrical Engineering Laboratories," D. C. Jackson, University of Wisconsin; "Minimum Laboratory Work and Equipment in a Civil Engineering Course," Dwight Porter, Mass. Inst. Technology; "A Few Mistakes in the Conduct of College Field Practice," O. V. P. Stout, University of Nebraska; "The Teaching of Structural Engineering," Edgar Marburg, University of Pennsylvania; "Relation of Practical to Theoretical Work in Civil Engineering Courses," Olin H. Landreth, Vanderbilt University; "The Education of Civil Engineers for R. R. Service," C. Frank Allen, Mass. Inst. Technology; "Mechanical Laboratory Work at Ames, Ia.," G. W. Bissell, Iowa Agr. College; "Amount and Kind of Shop-work Required in a Mechanical Engineering Course," C. W. Marx, University of Missouri; "Teaching Machine Design," J. H. Barr, Sibley College, Cornell University.

The election of officers for the ensuing year resulted as follows: President, Prof. Geo. F. Swain, Massachusetts Institute of Technology; Vice-Presidents, Prof. R. H. Thurston, Cornell University; Prof. F. O. Marvin, University of Kansas; Secretary, Prof. J. B. Johnson, Washington University, St. Louis; Treasurer, Prof. Storm Bull, University of Wisconsin; Members of the Council to serve three years: Profs. Randolph, Eddy, Flather, Kingsbury, Robinson, Jackson and Thurston.

The constitution was altered to permit the holding of the annual meeting in connection with either the American Association for the Advancement of Science or some one of the National engineering societies.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—The annual meeting has been held during the present week in Brooklyn, N. Y. Section D, Mechanical Science and Engineering, met on Aug. 16 and listened to the address of the President, Prof. Mansfield Merriman, published in full in our last issue. On the following day the section held a session for the reading and discussion of papers. Mr. J. H. Kinealy, of St. Louis, read a mathematical paper discussing the crank curve. Prof. D. S. Jacobus described the tests which are being made at the laboratory of the Stevens Institute, on the Uehling pyrometer, a new form of pyrometer which is claimed to register accurately temperatures up to the melting point of steel. Prof. Jacobus also read two other papers, one on precautions necessary in the use of mercurial thermometers for measuring high temperatures, and on the methods of testing the heads of automatic fire sprinklers, pursued in the Stevens laboratory. A paper by Prof. J. E. Denton on the ratio of expansions giving the most economic results for the engines of a river steamer was presented. The paper showed that in the special case for which the calculations were made a compound engine with 10 expansions was more economical than a triple expansion engine with 20 expansions. The concluding paper of the session was by Prof. Elmo G. Harris and discussed at much length the mathematical theory of the air-lift pump.

At a session of the section on Tuesday, Aug. 21, Prof. G. W. Plympton read a paper on the "Early History of Iron Bridge Building in the United States."

The Vice-President of the Section chosen for the ensuing year is Mr. William Kent, M. Am. Soc. M. E., Passaic, N. J. The Secretary is Prof. H. L. Jacoby, of Ithaca, N. Y. Prof. William P. Mason, of Troy, N. Y., was elected Secretary of the Chemical Section.

AMERICAN PUBLIC HEALTH ASSOCIATION.—The annual meeting will be held at Montreal, Sept. 25 to 28, in Association Hall, Dominion Square, opposite the Hotel Windsor. Special committees have been appointed and papers are invited on the following subjects: "The Pollution of Water-Supplies"; "The Disposal of Garbage and Refuse"; "Animal Diseases and Animal Food"; "The Nomenclature of Diseases and Forms of Statistics"; "Protective Inoculations in Infectious Diseases"; "National Health Legislation"; "The Cause and Prevention of Diphtheria"; "Causes and Prevention of Infant Mortality"; "The Restriction and Prevention of Tuberculosis"; "Car Sanitation"; "The Prevention of the Spread of Yellow Fever." In addition to the above, papers are invited on the following subjects: "On the Education of the Young in the Principles of Hygiene"; "Private Destruction of Household Garbage and Refuse"; "Disinfection of Dwellings after Infectious Diseases"; "Inspection of School Children with reference to the Eyesight." Papers will also be received on miscellaneous sanitary and hygienic subjects, but preference will be given to the topics named. All papers must be in the hands of the secretary at least 20 days before the meeting and papers on subjects before committees should be sent in earlier, so that they may be referred to the proper committee and included in its report, if desirable. Dr. Irving A. Watson, Concord, N. H., is secretary of the association.

AMERICAN INTERNATIONAL ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.—The fourth annual meeting of the association will be held at the Coats Hotel, Kansas City, Mo., Oct. 16, 1894. The subjects for report and discussion are as follows: "Depressed Cinder Pits and Other Kinds;" "Interlocking Signals;" "Best Method of Bridge Inspection;" "Pumps and Boilers;" "Maintenance of Pile and Frame Trestles;" "Best Scale Foundation." Subjects that have been previously presented will also be in order for discussion. Mr. J. E. Wallace, Springfield, Ill., is president, and Mr. S. F. Patterson, Concord, N. H., secretary of the association.

DENVER SOCIETY OF CIVIL ENGINEERS.—At the meeting on Sept. 11 the subject of irrigation canals, and their grade and alinement, with materials to be dealt with in construction, and the quantity of water to be carried, will be discussed. Messrs. J. C. Ulrich, Geo. G. Anderson, E. S. Nettleton and W. P. Hardesty are the committee in charge.

COMING TECHNICAL MEETINGS.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Sept. 1. Secy., O. Von Geldern, 719 Market St., San Francisco.
WESTERN SOCIETY OF ENGINEERS.
Sept. 5. Secy., Thos. Appleton, Lakeside Bldg., Chicago.
WISCONSIN POLYTECHNIC SOCIETY.
Sept. 10. Secy., Geo. G. Mason, 144 8th St., Milwaukee.
AMERICAN SOCIETY OF IRRIGATION ENGINEERS.
Sept. 10. Annual Meeting at Denver. Secy., J. S. Titcomb, Denver.
NORTHWEST RAILWAY CLUB.
Sept. 11. Secy., W. D. Crosman, Ryan Hotel, St. Paul.
NORTHWESTERN SOCIETY OF ENGINEERS.
Sept. 11. Secy., D. W. McMorris, Burke Blk., Seattle, Wash.
ROADMASTERS' ASSOCIATION OF AMERICA.
Sept. 11, 12, 13. New York. Secy., W. W. Sharpe, Way cross, Ga.
DENVER SOCIETY OF CIVIL ENGINEERS.
Sept. 11. Secy., F. Ed. King, 36 Jacobson Block.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Sept. 11. Secretary, F. C. Osborn, 721 Hickox Building.
ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE.
Sept. 13. Secy., G. W. Shaw, Norton Building.
COMMISSIONERS OF PUBLIC WORKS.
Sept. 19. Buffalo, N. Y. M. J. Murphy, St. Louis, Mo
AMERICAN PUBLIC HEALTH ASSOCIATION.
Sept. 25 to 28. Montreal, P. Q. Secretary, Dr. Irving A. Watson, Concord, N. H.
AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 2 to 6. Bridgeport, Conn. Secy., R. W. Raymond New York.
ASSOC. SUPERINTENDENTS OF BRIDGES & BUILDINGS
Oct. 16. Kansas City, Mo. Secy., S. F. Patterson, Concord, N. H.
AMERICAN SOCIETY OF RAILWAY SUPERINTENDENTS.
Oct. 20. New York. Secy., G. A. Hammond, Boston.

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The date when the subscription expires is on the address label on each paper; the change of this to a subsequent date is the only receipt sent, unless by special request.

ADVERTISING RATES: 20 cents per line agate measure. Want notices, special rates, see page 22. Rates for standing advertisements sent on request. Changes of advertisements must be in hand on Monday afternoon; new advertisements, Tuesday afternoon; transient advertisements by Wednesday noon.

The lowering of the transatlantic record by 3 hours and 18 minutes by the "Campania" last week is a notable event, and apparently makes the record secure with the Cunard company until some new transatlantic liner is afloat rivalling in size and power the "Campania" and her sister ship. At the present rate of progress the reduction of the record to five days would appear to be a matter of no long time. An average speed of 23 knots over the course run by the "Campania" in her last voyage would do it, and the prestige arising from the possession of such a record would be of such commercial value that the attempt to reach it is likely to be made.

A scheme of some interest to a certain class of people has been diligently presented to the attention of capitalists in New York and vicinity for some time, so far as we know, however, without much success. The claim of the inventor was that he could light three or four incandescent lamps with the same current that is now used to light one; and he proposed to do it by the use of a "current distributor," which would give each lamp in succession a "taste" of current, so to speak, the electricity being switched from circuit to circuit in rapid succession, and so quickly (according to the inventor) that the lamp would not begin to cool off before the current would reach it again. So far as we are aware the promoters of this scheme did not find business good in New York City, and we judge from an item in a recent number of the New Haven, Conn., "Leader" that they have transferred their base of operations to that city. The clipping is as follows:

> Arrangements have just been completed for the formation of a joint stock company to manufacture apparatus by which houses, stores, factories and other buildings may be lighted by electricity at a cost much less than it now costs where gas is used.
>
> The newly designed apparatus is the invention of Geo. T. Drabble, of Northampton, Mass., and is a great improvement on the Pinnock system, which is now being introduced with so much satisfaction. The organization is being perfected by Dr. W. B. Beebe, of Bridgeport. The apparatus is exceedingly simple, consisting of a motor by means of which the regular current furnished by the New Haven Electric Lighting Co. can be so multiplied that many times the number of lamps now used on the system can be lighted without losing a single iota of candle power. This motor is of peculiar construction and multiplies and distributes the electrical energy by the extra efficiency of the armature.
>
> The company also controls the right to make and use the Pinnock system. The latter system is now used to light four lamps by the same amount of energy that it requires to light one by means of the regular current. By the Drabble improved system in an actual test 144 lights were obtained from a 32-light dynamo.
>
> The apparatus is about to undergo a severe test at the psychological laboratory of Yale University. The test is being made for the purpose of establishing the efficiency of the apparatus beyond any sort of doubt.

We should think a psychological laboratory would be a highly appropriate place to test the invention.

The cost of the great railway boycott of last month is just now being diligently "written up" by the daily newspapers, and various ingenious comparisons are drawn with the national debt, the whiskey tax, Germany's army tax, etc., etc., for the edification of the curious public. Amusing in their misstatements as many of these calculations are, they may serve a good purpose if they aid to bring home to the people the fact that the last great railway boycott by labor has been a boycott of labor by itself, and that any similar boycott must inevitably have the same final results. In round figures the cost of the strike to the railways entering Chicago in property destroyed and traffic delayed and lost is conservatively estimated at from $5,000,000 to $8,000,000. To this amount is to be added the loss in perishable commodities to Chicago commission merchants and the cost to the Federal and state governments of subduing the insurrection, which may very likely bring the total well up toward the $10,000,000 mark. It can easily be seen upon whom this loss will fall. A very large proportion of it will fall directly on the taxpayers of Chicago and Cook county in payment of damages wrought by the riotous mobs upon railway property; a second and smaller portion will fall on the general public in increased national and state taxes to pay the cost of the military, in business lost by the interference of transportation, in capital discouraged from investment, and a third, and still smaller, proportion will have to be paid by the railways in decreased ability to expend money in permanent improvements and operating expenses. How much of this decreased ability to spend is borne by capital and how much by labor? Taking at random half a dozen Chicago roads, we find the proportion of their annual expenditure which goes directly to labor in wages to be as follows, according to the "Wall Street Journal":

Lake Shore & Michigan Southern	63½%
New York, Chicago & St. Louis	50.9%
New York, Lake Erie & Western	50.9%
Pennsylvania Co.	67.8%
Chicago, Milwaukee & St. Paul	67½%
Chicago, Burlington & Quincy	66⅔%
Chicago & Northwestern	64½%

The proportion which goes indirectly to labor in supplies purchased has to be added to this, and makes labor's share probably 60 to 65% of the total expenditures. The American railway employee is too intelligent a man not to see the foolishness of carrying on a battle in which the rebound of every blow he gives his opponent cracks his own pate with triple force; the thing is to make him comprehend that this must be the result when he tries to boycott the company for which he works.

Every thinking and observant man must deplore the fact that while the newspaper press might do more than any other agency to teach sound economics to the people, it actually is almost inert, and its devotion to sensationalism leads it to offset the good it does do with a great deal of harmful and misleading matter. We have been at some pains to note the stand taken by the Chicago press toward the strikers, both during and since the trouble, and, with one or two notable exceptions, the daily papers have not furnished evidence of the logical and fair-minded attitude towards both sides of the question at issue which should be expected of them. They have, it is true, been emphatic in condemning lawlessness, and in their strictures of those who have tried to make political capital out of the trouble, but they seem to have no appreciation of the fact that the great mass of the workmen may have sinned through ignorance and that it is their duty to teach as well as to admonish. Even some of our technical contemporaries seem to have forgotten that invective was neither argument nor instruction.

Hardly six weeks ago the Statistician of the Interstate Commerce Commission sent broadcast a preliminary report of the results of railway operations in the United States for the year 1893, adapted for the newspaper press. There were probably very few of the larger papers throughout the country which did not give some space to these figures, but we have not seen a single one which made the slightest effort to analyze these figures and point out how great a portion of the operating expenses of these roads goes to the employees in the shape of wages, and how small is the income to stockholders upon their investments? Calling Debs a demagogue and asserting that he will use the strike as a stepping stone to political office does no good. The intelligent workman will say that this has a personal application to Debs, but it does not prove that the wage-earners are obtaining a fair share of the products of their toil. Show the workman, however, that out of every $100 earned by the railways in 1893, $68 went to pay operating expenses, $23 went to pay the interest on borrowed money, and only $9 to pay dividends to stockholders; that from $60 to $65 went directly to pay wages, and he will then see what it means in dollars and cents to himself and to the public to wilfully interrupt commerce. This is a very elementary lesson, we admit, but it is one which must be learned by the great mass of railway employees and one which the newspapers can teach if they would.

A report has recently been published giving the results of an expert examination as to the best means of improving the vaults of the U. S. Treasury Department, especially with a view to rendering them safe against burglars or mob violence. The experts selected were Dr. R. H. Thurston, Director of Sibley College, Cornell University; Mr. Theo. N. Ely, Chief of Motive Power, P. R. R., and Mr. F. A. Pratt, men well known for their scientific attainments and practical experience. This commission most carefully and intelligently investigated the whole subject, as the voluminous report and many photogravures of safes opened by them by "mechanical burglary" testify. The general result of their examinations would seem to be that no "safe" can be made secure against forcible entry by burglars, when sufficient time is given them and they are provided with good tools. The laminated safes, made of alternate plates of tough mild steel and high carbon, or chrome steel, were found to be especially susceptible to attacks by high explosives and in all cases succumbed to the attacks by the commission's workmen. The extreme hardness of the alternate steel plates was also supposed to resist drilling in any reasonable time, but it was found that five-ply chrome steel plate could be heated red hot in five minutes by a small apparatus that could be carried in an ordinary travelling bag, and a hole 4 ins. in diameter was then drilled through it in less than 30 minutes.

The commission recommended for bank vaults the massive chilled iron construction devised by a Pittsburg firm. This consists of blocks of cast iron, chilled for 1½ ins. on the outside surface and weighing several tons each, laid up like masonry, with ingeniously devised dovetails, rabbets and bolts practically converting the whole into one mass. The report deals at full length with locks, bolts, doors, etc., and recommends the automatic time-lock as the best, because it alone does away with the necessity for openings through the door for spindles to turn the bolts. For the protection of ordinary safes against burglary, the best of all devices is some form of the several electric alarms. In this device the safe is completely enclosed in a casing, concealing a network of wires, through which a current of low tension is continuously circulating. Any attempt to open the safe or cut the wires breaks the circuit and sends an alarm to the police or other central and well-guarded station provided. The commission also highly commended the Corliss form of safe, with its spherical single casting of chilled iron, and spherical door, fitting upon faced and stepped joints. An exhaustive trial was made with a 36-in. safe of this type, and as much as 27½ lbs. of forcite powder were exploded against it in ten several attacks without the safe showing any tendency to open at the joint between the door and the door frame. The tests of this safe were very severe, and the conclusion was that the Corliss safe was proof against any mob violence brought to bear upon it through the agency of dynamite or other explosives. The report concludes with full specifications for the government vaults at Washington and New York. The so-called "franklinite" plates, made of cast iron with about 10% manganese alloyed with it, are recommended as a material very difficult to drill; but it is brittle and easily broken by sledges. When used

it should be cast upon a grid of wrought iron or soft steel, or cast in somewhat thick and heavy plates, as a substitute for the ½-in. plates of hard steel before mentioned.

As already commented upon in our issue of July 5, our London contemporary, the "Engineer," has been lately publishing letters nominally discussing "Engineering as a Profession," but really devoted to the ventilation of personal grievances and the expression of personal disappointment at the small financial returns to the writers in practice. The "Engineer" now editorially points out that in these letters the writers take two sides—the professional and the trade—and properly says that engineering as a trade has no place in a discussion of engineering as a profession. Many, in England at least, enter upon engineering as they would become lawyers, doctors or clergymen, with the desire to be ranked with the professional men in contradistinction to tradesmen. To these, it must be admitted, engineering does not open a hopeful prospect unless they possess special genius. But our contemporary goes on to say that the title "profession" is too narrow for engineering, and from some unknown source quotes the following definition: "An employment not mechanical, and requiring some degree of knowledge." As the "Engineer" says, the definition is entirely inapplicable, for the work of the engineer must be always more or less mechanical, "and," continues the editor, "it is possible to be a successful engineer without either being a professional or a tradesman."

To this expression of opinion it can be answered that the fault lies rather in the unusual and wholly insufficient definition for "profession" used by the "Engineer." As defined in the latest American authority, the Century Dictionary, a profession is "The calling or occupation which one professes to understand and to follow; vocation; specifically, a vocation in which a professed knowledge of some department of science or learning is used by its practical application to affairs of others, either in advising, guiding or teaching them, or in serving their interests or welfare in the practice of an art founded on it." A century or less ago, theology, law and medicine alone ranked as professions; but as the applications of science and learning were extended in later years other vocations properly came under this head and are so generally recognized. The word now implies professed attainments in special knowledge as distinguished from mere skill; a practical dealing with affairs as distinguished from mere study, and the application of this knowledge to the affairs of others, rather than the pursuit of a calling for one's own purpose alone. Looked at in this light, engineering is distinctly a profession; and as far as the mechanical element is concerned, a man may be a very successful mechanical engineer and design important, useful and well-adapted machines without necessarily being a "skilled mechanic," so far as that term applies to the actual construction of the machine devised. He must thoroughly understand mechanics as a science and possess sufficient knowledge of the methods of the skilled mechanic to properly block out work for him; but he can stop there. There is, then, no need, as our contemporary suggests, for the coining of a new word to more exactly define the work of the engineer. For the benefit of those correspondents of the "Engineer" who somewhat sneeringly refer to engineering in some of its branches as a "trade"—and the word "trade" yet grates upon the sensitive ear of many Englishmen—we would recommend that they modify their definition of the term "profession" or adopt the one quoted by us as being less antiquated and better expressing the modern and generally accepted meaning of that word.

MOTOR-DRIVEN CARRIAGES FOR COMMON ROADS.

The recent French competitive test of road carriages operated by motors of various types, which is described elsewhere in this issue, is a good illustration of the adage that history frequently repeats itself. When the use of steam was first suggested as a means of propelling vehicles on land, the new motive power was commonly thought of as a possible literal substitute for horses on the common roads of the country. The idea of providing a smoother and firmer roadbed, offering less resistance to traction by laying down lines of rails came later with the development of the locomotive and with a clearer understanding of the field the locomotive was to occupy.

The idea of a steam road carriage occurred to Watt as long ago as 1769, for in his patent of that date he included the employment of his steam engine for running carriages on the land; but he never carried this idea into effect. Some authorities give the Frenchman Cugnot credit for a similar purpose, and, in the same year, 1769, he actually built a locomotive with a pair of 13-in. single-acting cylinders, operating a crank that drove a single driving wheel with a roughened periphery. This engine is still preserved in Paris. Hornblower, in England, is also credited with the invention of a steam carriage at about the same time; but the Cornish engineer, James Murdoch, in 1784, certainly did make a road engine and he tested it with somewhat striking results, according to current story. In his model, heat was applied by a lamp, and he modestly saw fit to make his first test on a dark night. He fired up his engine, and when all was in working order, connected the working parts, when it got away from him and started at full speed down the road. The fiery, puffing little engine is said to have met the clergyman of the parish in its erratic course, and frightened that worthy gentleman into believing that he had at last actually met that Evil One against whom he hurled weekly invectives from his lofty pulpit. Be that as it may, Murdoch made a road engine, and his crude model is still preserved in England, or was as late as 1850.

In America, Oliver Evans, as early as 1787, obtained a Maryland patent, giving him the exclusive privilege of making "steam wagons for use on roads and railways." And in 1801 he built a floating dredging machine, operated by the first successful double-acting high-pressure engine ever made. By putting wheels under his boat and connecting them with his engine, he propelled this nondescript craft 1½ miles overland to the point of launching.

But these early and clumsy attempts at building steam engines to run upon the common highways failed to materialize into anything of real service, for several reasons. In the first place, these highways were in a notoriously bad condition, as a rule, and the roadbed provided was not adapted to the weights deemed necessary and the lack of power characterizing these earlier machines. Then, too, the managers of the turnpikes took fright and violently opposed what they believed might eventually interfere with the use of horses and their tolls. But probably the most potent cause of arrested development in road carriage construction was the fact that about 1802 Trevithick and Vivian demonstrated the fact that it was possible to run steam engines upon a smooth line of rails, even upon slight gradients, and the attention of inventors was turned in the new direction.

About 1828, however, in the general railway craze then prevailing, the subject of road carriages again came forward somewhat prominently, and a great deal of ingenuity was displayed, for that time, in meeting the supposed demand. In our issues of Sept. 8, 1888, and Dec. 21, 1889, will be found some illustrations of what the good people looked forward to. Steam "buggies" were to supplant horses and steam stage coaches were really built and run for some time for hire. It is sufficient here to note among these the steam coach of W. H. James and Sir James C. Anderson, of 1829, which carried four to six passengers, and, on its trial trip, from Vauxhall Bridge to the "Swan," in Clapham, ran the 2½ miles in ten minutes, at a speed equivalent to 15 miles per hour. This coach weighed less than one ton, with fuel and water on board.

In 1831 Sir G. Gurney built a steam wagon and ran it between Cheltenham and Gloucester, a distance of nine miles, and with from 10 to 12 passengers frequently made the trip in 40 minutes. Gurney, later, attached a coach to his motor, and thus carried 33 passengers over the same road in 50 minutes. He ran his coach for four months and carried over 3,000 passengers, and attempted to extend its use throughout England and Scotland. But the success of the trial at Rainhill and the speedy extension of railways, coupled with the difficulties of adapting his road wagon to the varying condition and gradients of common roads, put a quietus upon further effort in that direction. That the effort to introduce the road carriage, however, was an earnest one, while it lasted, is made plain by the number of devices proposed and described in the journals of the day. Among these inventors may be mentioned Julius Griffiths, in 1821, and Messrs. Burstall, Hill, Bramah, Seaward, Dance, Hancock, Ogle and Summers, in England and Scotland, and in America, Harrison Dyar, Joseph Dixon, Rufus Porter and Mr. James, who all attacked the problem with more or less success. Even upon the railways of England to this day, the preservation of at least the outline of the coach body in the railway carriage bears witness to the original thought in the employment of steam for moving land vehicles.

The famous trial of locomotives on the Liverpool & Manchester Railway, in 1829, and the genius of Stephenson, Braithewaite and Ericsson soon demonstrated the fact that to successfully run a locomotive you must first provide a proper roadbed, and from that time until within a very recent period the subject of mechanically-propelled carriages for common roads was practically dropped. The railway was steadily developed along with the locomotive, and except for adaptations for agricultural purposes, or for hauling heavy loads about docks, etc., the road engine no longer attracted the attention of inventors. But well within the last decade, and encouraged by the wonderful recent developments in motors, in fuel, and in mechanical science generally, inventors have again taken up the problem so long ago laid aside.

France, with its excellent system of government roads, has taken up the subject in earnest, as the number of machines originally entering for the trial instituted by "Le Petit Journal" testify. According to the reports of this trial, motors operated by petroleum or gasoline used in a gas engine, promise the best results. Though the weight is still considerable as compared with an ordinary carriage, this is not a serious fault, and much mechanical skill and ingenuity have been displayed in designing, stowing and connecting the parts of the motor so as to furnish a compact and neat-looking vehicle. The speed attained is fully sufficient for all practical purposes and the first cost is by no means excessive, as contrasted with the expense of keeping horses and a coachman. The report does not deal with the subject of the amount of skill and experience necessary to handle a road carriage of the Daimler-gasoline type, but this ought not to be great. The most serious fault found, apparently, is with the odor from the gaseous exhaust and the vibration of the carriage when the motor is still running but is disconnected from the driving gear.

Steam comes next to petroleum in point of adaptability, though it is best adapted for hauling heavier loads in omnibus traffic. The Serpollet boiler is a favorite here, with its very heavy section of coil, its vertical form and the small amount of water carried in it at one time. Steam can be raised very quickly with it and a high pressure obtained, and the heavy coil, with a small quantity of water circulating through it, decreases the danger from rupture and reduces this danger to the lowest limit possible, all very important considerations in a motor of this character.

Compressed air and electricity cannot as yet be usefully applied for this purpose, though the attempt has been made. If air is used, it must be compressed to a pressure of 1,000 lbs. per sq. in., or more, and this demands strong and heavy cylinders. And to provide against freezing at the exhaust another cylinder must be carried, charged with heated water, through which to pass the air on its way to the motor, on the Mekarski principle. Weight and power storage capacity are here the difficult problems to solve.

With electricity, the storage battery system seems alone to apply, and here again weight of dead load enters as a potent factor. In the one electric road carriage which entered the French trials the total weight was 1,000 lbs., with 500 lbs. of this in the storage batteries alone. Then, too, the jolting of the carriage is liable to flake off the paste used upon the leaden grid, a trouble present even when the carriage runs upon smooth rails. Another difficulty lies in the application of the electric power to the driving axle and the reduction of the high speed of the motor to a speed suitable for driving and to the variation in speed that such a carriage must pos-

sess. What the immediate future of the storage battery system may develop in this form of applying power, no one can now foretell; but the possibilities are great and if it could be economically and efficiently applied, electricity is certainly the least objectionable of all forms of power applicable to this use.

The whole subject is practically a new one as it is presented to inventors at the present time, and with the present wonderful advance in mechanical science over the slight knowledge possessed by the inventors of 1830, the achievements and lack of practical success of that day can in no way measure the possibilities of the immediate future.

That there is a vast field open, when once the application of mechanical motors to ordinary road vehicles is made practical, requires no proof; and while improved highways will greatly facilitate the solution of the problem, on the other hand the introduction of mechanically propelled vehicles will give a new stimulus to the movement for better highway construction.

LETTERS TO THE EDITOR.

CREDIT FOR MR. J. T. RICHARDS' PAPER.—CORRECTION.

Sir: In your issue of Aug. 16 I see that you republish an abstract of a paper on "Rebuilding the Pennsylvania Railroad after the Flood of 1889," and in a footnote state that it is an "Abstract of a paper read at the convention of the New England Roadmasters' Association, at Boston, Aug. 15, by Mr. Joseph S. Richards, Engineer of Maintenance of Way, Pennsylvania R. R." I beg to call your attention to the fact that this paper was read at a regular meeting of the Engineers' Club of Philadelphia, June 2, 1894, by Mr. Richards, and was published in full in the "Proceedings of the Engineers' Club of Philadelphia" (vol. XI., No. 3, for April-June, 1894. This number of the Proceedings was issued July 20. I make this statement in order that the Engineers' Club of Philadelphia may receive proper credit for the paper.

Most truly yours, Silas G. Comfort,
Chairman Publication Committee Engineers' Club of Philadelphia.

Chester, Pa., Aug. 17, 1894.

(We must apologize that by oversight credit was not given to the Philadelphia Club's "Proceedings" in the first instance.—Ed.)

CEMENT JOINTS FOR CAST IRON GAS AND WATER MAINS.

Sir: It may be news to some of your readers, as it was to me, that most excellent joints for gas pipes can be made with Portland cement and oakum. This joint has been used by the Hornellsville Gas Co. for 30 years, and they report a leakage from their pipes of only 2½%. The joint is used on an ordinary bell and spigot cast iron pipe, and is made by first calking with a liberal quantity of oakum, then a layer of Portland cement well rammed in, then a smaller layer of oakum and finally finishing with a smooth and firm coating of Portland cement. This joint has stood a test pressure of 400 lbs. per sq. in. Why could it not be used with success and economy for water pipe joints, and do you know if it has ever been used for this purpose, and whether it is used to any extent for gas pipes?

Yours truly, F. W. Dalrymple.

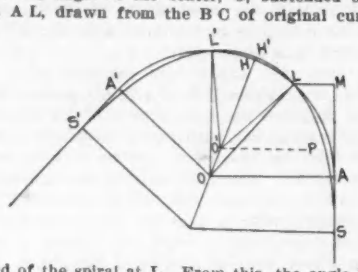
Hornellsville, N. Y., Aug. 1, 1894.

(Several instances of the use of cement joints for cast iron water mains have been recorded in this journal, all but one of which showed satisfactory results. The exception was briefly noted in our issue of May 5, 1892. The other references to this journal are June 23, July 14 and Sept. 8, 1892. The article in the latter issue summarizes the information previously given, and, in addition, presents a diagram and a table relating to the dimensions of bells and spigots used in England for cement joints in pipes from 2 to 24 ins. in diameter. No instance of the use of cast iron gas mains with cement joints has previously come to our attention. We should be pleased to receive further information regarding the use of cement joints for cast iron mains.—Ed.)

TRANSITION CURVES.

Sir: The accompanying figure illustrates a simple method of finding the distance, A S on the tangent, from the B C of a simple curve to the point P S of a spiral, or transition curve, and also the radius, R′, = L O′, of the arc, L H′ L′, joining the two spirals that ease off the ends of the original curve, A H A′.

In selecting a spiral, the ordinates, S M = y, and L M = x will be given, and by making the extremity, L, of x lie on the original curve, we have x = versed sine of the angle at the center, O, subtended by the chord, A L, drawn from the B C of original curve to



the end of the spiral at L. From this, the angle L O A is at once obtained, from which we have

$$A\,M = \frac{x}{\tan \frac{1}{2} L\,O\,A},$$

and A S = y − A M.

In the triangle, L O′ O, L O = radius, R, and L O′ = radius, R′; angle, L O O′ = ½ the central angle, H O A, — L O A, and H′ O′ L = ½ central angle, H O A, — the spiral angle s, = H′ O′ P. From these data the radius, R′, and the distance, H H′ = h, are at once obtained without any approximations or interpolations. This method is based on Searle's location of the railway spiral by deflection angles from S. By a judicious selection of spirals this method will replace a simple curve by spirals and are lying practically on the same ground, and not differing materially from the original length of curve for any curve under 10°, as the following examples show, "n" being the number of chords in the spiral and "c" their length:

1° Curve.

½ central angle = 8°	R′ = 1° 00′ 40″ C.
N. C. = 3 × 50	A S = 41.3
y = 149.995	h = .73
x = 1,018	S L H′ = 841.76
s = 1°	A S + A H = 841.30
	+ .46

3° Curve.

½ △ = 15°	R′ = 3° 05′ 20″ C:
N. C. = 5 × 30	A S = 57.11
y = 149.969	h = 2.23
x = 2.4	S L H = 554.66
s = 2° 30′	A S + A H = 554.07
	+ .59

6° Curve.

½ △ = 34°	R′ = 6° 07′ 12″ C.
N. C. = 6 × 19	A S = 44.68
y = 113.954	h = 2.934
x = 2.514	S L H = 612.314
s = 3° 30′	A S + A H = 611.354
	+ .96

10° Curve.

½ △ = 50°	R′ = 10° 09′ C.
N. C. = 7 × 13	A S = 35.86
y = 90.936	h = 3.24
x = 2.646	S L H = 537.63
s = 4° 40′	A S + A H = 535.86
	+ 1.77

In this method there is one particular spiral that will give the smallest variation for any particular case, and judgment and experience will enable one to select the best with but few trials. The spirals given in these examples were taken at random and better ones can doubtless be chosen.

The length of curves above are figured on the chords, but this does not materially affect the comparison. The above calculations are not checked, but judging from the regular variations in a large number of calculated curves and spirals, there are no important errors.

J. L. Campbell.

P. O. Box 117, El Paso, Tex., May 18, 1894.

PATENTS ON HYDRAULIC DREDGES.

Sir: For some years past the profession has been familiar with the operation of the hydraulic dredger known as the "Von Schmidt" machine, which has been so extensively used on the Potomac in reclaiming the "Flats," at Norfolk, in building up the comprehensive terminus of the Norfolk & Western R. R. at Lambert's Point and reclaiming the handsome suburb of Beechwood and in many other places.

It will be interesting, no doubt, to your readers to learn that the litigation so long pending in the Circuit Court for the Northern District of California, has at last terminated in a decree awarding to Mr. Alonzo B. Bowers the priority of invention, with full damages and costs. The decree was issued July 23, 1894, and Mr. H. H. Heacock has been appointed Master in Chancery to examine into and determine the extent to which the hydraulic machines—containing a dredge boat, a floating pipe composed of sections flexibly joined together, a land pipe, a flexible joint between them; also a bottomless bucket excavator, a non-rotating suction pipe, a center of oscillation and other elements—have been built and used in violation of these patents, and to determine the extent of the damages.

The remarkable results of these machines as perfected by Mr. Bowers is evinced by the record of one of the smaller sizes (No. 3) at South Bend, Wash., where it handled 150,000 cu. yds. of sand and clay in 20 days.

The history of the invention and the struggles of the inventor would make an interesting romance, on a par with that of nearly all great improvements in the arts or sciences. After a quarter of a century of conflict and severe mental stress the inventor has attained his reward. This advanced machine is destined to play an important part in the ship canal movement, and in the reclamation of marsh lands on tidal waters for terminals for railways and other purposes. A description of the Bowers dredge with some account of its work was given in Engineering News of Aug. 4 and Aug. 11, 1892.

Very truly yours, L. M. Haupt.

Philadelphia, Pa., Aug. 11, 1894.

RED LEAD PAINT FOR BRIDGES.

Sir: There is a prevailing opinion among engineers who use red lead paint that it will set and become worthless after about 30 days, even when mixed with lampblack in the proportion of one ounce of lampblack to the pound of red lead. The B. & O. R. R. has for the last year and a half been using pure red lead paint mixed with lampblack in the proportion of 10 oz. of the latter and 12 lbs. of red lead to the gallon of paint, and have had this mixture shipped in barrels with instructions that the barrels be agitated each day until used. The paint was, in general not used until three or four months after having been shipped and did not present the least sign of setting or hardening.

In one particular case, several barrels of this paint remained undisturbed for a period of four or five months. When examined for use, the red lead had settled to the bottom of the barrel, but was easily mixed with the oil, and when, two months later, it was applied to the bridge, no one could see the difference between it and paint freshly mixed. Of course, the lampblack used was the common commercial lampblack and not the refined article. Yours truly,

J. E. Greiner,
Engr. of Bridges, B. & O. R. R.

Baltimore, Aug. 6, 1894.

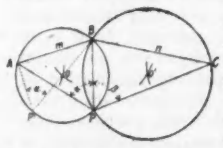
THE THREE-POINT PROBLEM.

Sir: Never having seen the following solution of the Three-Point problem, I send it to you for publication. It can be used with great accuracy, and is a more rapid method than that ordinarily employed.

Having given three points whose relative positions are known, it is required to determine the position of a fourth point by means of angles taken on the other three points.

Let A, B, C be the three points whose relative positions are known, and α and β the observed angles taken from the fourth point, P.

To Locate P.—Since through any three points not in the same straight line a circle may be drawn, it will be readily seen that two circles, one passing through A, B, P, and the other through B, C, P, will intersect at P.



In any segment of a circle all the angles formed by drawing lines from the extremities of the chord to any point in the circumference, are equal. Therefore, we may suppose α to be shifted to the position P¹, so that P¹ B becomes a diameter of the circle A B P, α still retains its true value, and in this position it is readily seen that m = Diameter × sin α, or $m = 2R \sin \alpha$.

$$\therefore R = \frac{m}{2 \sin \alpha} \qquad (1)$$

Similarly for the circle B C P,

$$R^1 = \frac{n}{2 \sin \beta} \qquad (2)$$

These two equations determine the location of the point P. Set the dividers for R, and from each of the points A and B describe an arc. These arcs will intersect at o, from which point describe the circle A B P.

Similarly with a radius R^1 describe the circle B C P. The point of intersection of these two circles determines the position of P.

Analytical Solution.—Having found R and R^1, the problem may be solved as follows: Angle A B C + $(\alpha + \beta) - 180° =$ angle o B o^1. Find angle o^1 o B. Twice this = angle B o P. Find side B P. This gives the necessary data for solving the triangles A B P and B C P.

Very truly, Geo. W. Sykes, C. E.

Mercer, Pa., July 16, 1894.

NOTES AND QUERIES.

S. L. K. asks whether it is proper in testing new water mains laid in connection with an old system to first let out the air, or to close all hydrants and openings and turn on the water pressure, letting the air take care of itself? We should think it a fairer test of the tightness of a job to let out the air first, for the reason that a system of mains which would be practically water-tight, would be very far from being air-tight. A minute leak in a joint, through which water would barely ooze, would let out a considerable quantity of air.

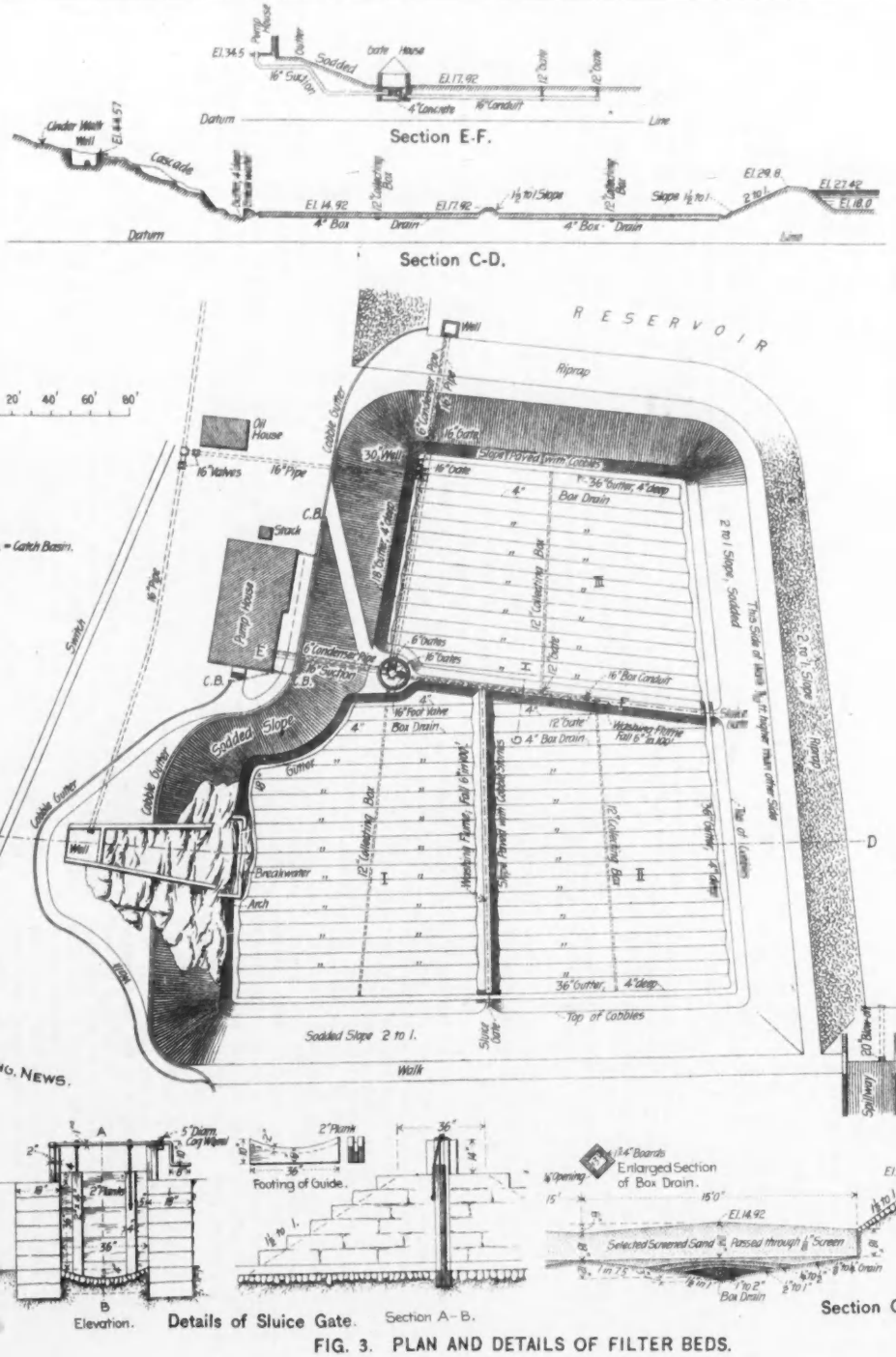


FIG. 3. PLAN AND DETAILS OF FILTER BEDS.

FIG. 2. LOCATION OF FILTER BEDS, PELHAMVILLE RESERVOIR.

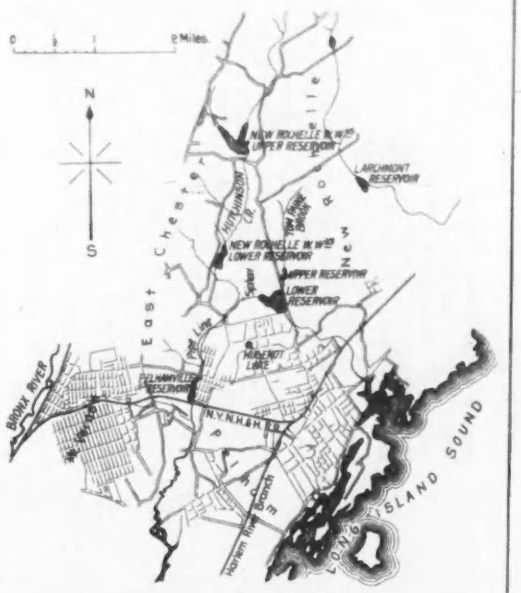


FIG. 1. GENERAL MAP SHOWING SOURCE OF MT. VERNON WATER SUPPLY.

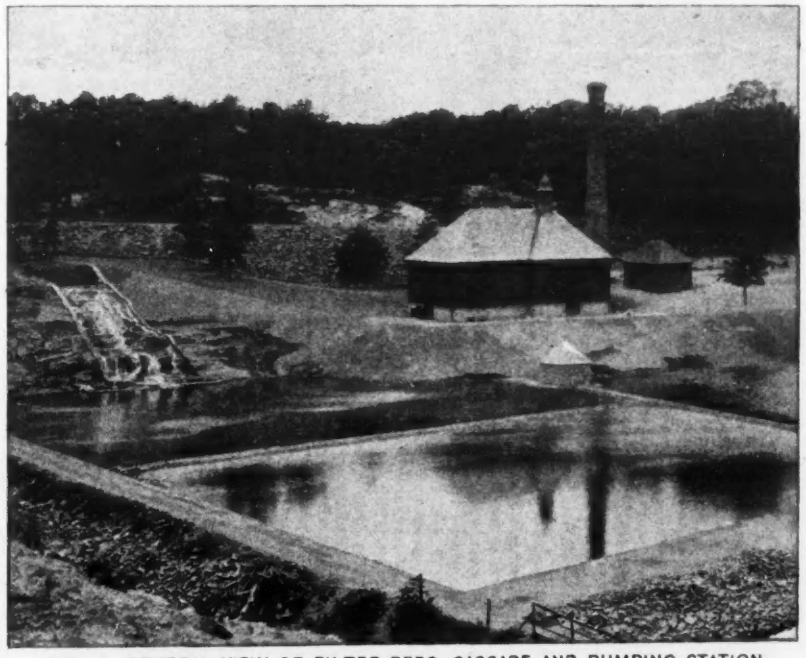


FIG. 4. GENERAL VIEW OF FILTER BEDS, CASCADE AND PUMPING STATION.

Aerating and Filtering Plant for the New York City Suburban Water Co., Mount Vernon, N. Y.

J. M. Howells, Chief Engineer; J. N. Chester, Constructing Engineer; A. H. Kneen, Assistant Engineer.

CHAS. HART & SONS, LITH., 26 VESEY ST., N. Y.

WATER PURIFICATION IN AMERICA.

(Continued from p. 532, vol. XXXI.)

(With inset.)

Aeration and Intermittent Sand Filtration at Mount Vernon, N. Y.

The second city in the United States to enjoy the benefits of the experiments in water purification made during the past few years by the Massachusetts State Board of Health is Mount Vernon, N. Y. Lawrence, Mass., was the first city to build and operate a water filtration plant in accordance with lessons drawn from the above experiments, Mr. Hiram F. Mills, who has had charge of the experiments, having designed the plant. The Lawrence plant was put in operation in September, 1893 (see Eng. News, Aug. 3, 1893), and water was turned into the Mount Vernon filters on Aug. 1, 1894.

Mount Vernon has a surface water supply, drawn largely from impounding reservoirs on two small streams. The drainage area is sparsely settled, but there has been some complaint regarding the quality of the supply, and in the summer months it is said that the amount of organic matter in the water is sometimes high, though always below the generally accepted danger limit.

The population of Mount Vernon was 10,830 in 1890. The city is a suburb of New York, and is growing rapidly, so that its present population is considerably above that of 1890. The water-works are now owned by the New York City Suburban Water Co., which, in 1892, succeeded the New York & Mount Vernon Water Co., by which a water supply was introduced in 1886.

Since the works came into the hands of the new company extensive improvements have been in progress, including filter beds, just put in operation, the enlargement of a storage reservoir on a new drainage area and the construction of a gravity pipe line to connect the new supply with the old. A siphon on the new pipe line was described and illustrated in Engineering News of May 4, 1893. The location of the reservoirs, pipe line and pumping station is shown in the plan, Fig. 1, on the inset sheet. This plan also shows the location of the reservoirs which supply New Rochelle, the pipe line from which crosses the Mount Vernon conduit, and can be connected with it in case of emergency.

The new filter beds have been built close by the pumping station at Pelhamville, and, together with the cascade, may be seen from the trains on the New York, New Haven & Hartford R. R. The filter beds are in one corner of the Pelhamville storage reservoir, as shown in Fig. 2, an embankment having been built on two sides of the beds to shut off the reservoir water.

For the information regarding the purification plant we are indebted to the Chief Engineer of the New York City Suburban Water Co., Mr. J. M. Howells, of Chicago, and to the company's constructing engineer, Mr. J. N. Chester.

Mr. Howells has written us briefly regarding the aerating feature of the plant and the care taken in the construction of the storage reservoir, as follows:

As to the aerating cascade, there are times, only, during the year when this is of any particular value, for the new reservoir under construction is large enough and deep enough to permit of high wave action and aeration will usually be complete before the water supply reaches the cascade. It might be said in this connection that this storage reservoir is among the few in the United States in which the entire bottom is being excavated to an absolute level, and all slopes made steep and stone revetted, so that no shallow margins exist to encourage the growth of aquatic plants.

After receiving general instructions from Mr. Howells regarding the design of the plant, Mr. Chester visited the Lawrence filter beds, the state experiment station, located in Lawrence, and the sewage filter beds at Marlborough, Mass., paying especial attention to the sand employed and the method of selecting and preparing it for use. He then proceeded with the construction of the plant, the design and details of which are clearly shown by the drawings and view on the inset sheet.

One of the views in the text, Fig. 35, shows the apparatus used for screening sand and gravel, which was located on the bank of the filter beds. The other view, Fig. 36, shows the aerating cascade and a corner of one bed partially covered with water.

The following account of the construction of the plant is taken from Mr. Chester's report, as Constructing Engineer, to the Chief Engineer, Mr. Howells:

The first work was to extend the suction pipe to the outlet edge of the proposed earth dam. This being done, work was immediately begun upon the earth-dam by removing the ice which had been left upon the ground when the water was wasted out of the reservoir, and by hauling in clay with carts and backing up to dump, thus keeping a firm footing for the horses. As soon as the foundation of the embankment was completed a 750,000-gallon Worthington pump was set up in one corner of the basin and connected with the boilers in the pump house. With this the work was kept drained, the pump running five months without further attention than to be oiled once every 12 hours. Work of excavating and deepening the basin, which was divided into three smaller basins, was next begun, and the dam built up with the material taken out. Plank runs had to be used a great deal of the time, as it was impossible to keep the basin drained dry. When the dam was completed the surplus material excavated was disposed of on the company's ground.

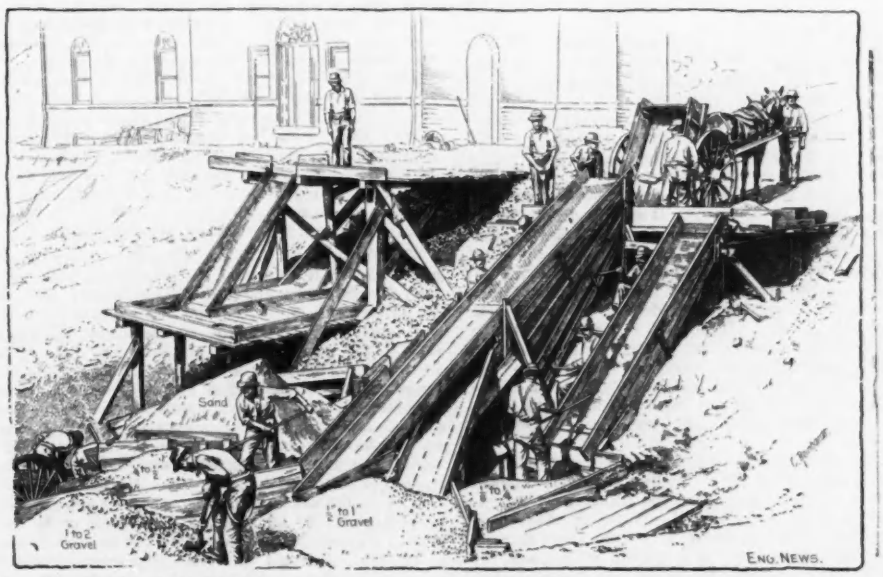


FIG. 35. SAND AND GRAVEL SEPARATING SCREENS AT THE MOUNT VERNON FILTERS.

The plan for filter beds decided upon was individual filters 15 ft. wide, extending across each minor basin. (By individual filter beds Mr. Chester means that section of each main bed which is served by one drain. The plan of the beds and arrangement of filtering material, collecting drains and conduits is shown by the plan and sections, Fig. 3.—Ed.)

We calculated upon getting the sand and gravel from the bottom of the basin, but in this we were disappointed. In the west side of Bed No. 1 was found a few cubic yards, which barely stood the test. This sand was taken out and put on a pile by itself and used in tempering sand that was found too coarse. The final question of where the sand was to be obtained was settled when within 200 ft. of the site of the filter was discovered a deposit of sand of the right grade, and from this bank five-sixths of the entire sand and gravel was taken, one-sixth being obtained from two other banks about one-quarter mile distant. All the sand comes within Mr. Allen Hazen's requirements for No. 70 sand. (Capable of passing 70,000,000 gallons per acre per day through one ft. of depth with 1 ft. head, when the sand is clean and the water has a temperature of 50° F.—Ed.)

The screening and separating process (see the view, Fig. 35,) was as follows: At the top of the old slope of the bank of the basin, which was approximately 2 to 1, 14 ft. deep, a platform 16 × 20 ft. (at the left in Fig. 35) was built for the reception of the material, as it came from the sandpit. From this platform to one 8 ft. below extended the sand screen, 30 ins. wide, at an angle of 45°. At first screens were used with ⅛ × 7-in. meshes, but these were afterwards replaced by screens having ⅛ × 2-in. meshes. The lower platform was 6 ft. above the ground or bottom of the basin. It was divided into two bins, one for sand and the other for gravel. In the center of the bottom of each bin was a slide door, so arranged that by backing carts under the platform they could be quickly loaded by simply sliding back the door. These screens served simply to separate sand from the gravel. The sand so separated was carted direct to the filters. The gravel was carted to the top of the bank and dumped upon a platform alongside of the one just described, and then shoveled into the gravel separator. This was built of four different screens, with meshes of 1, ½, ¼ and ⅛ ins., respectively. These screens were placed at angles determined by experiment, the finer the screens the greater the angle, and when gravel was wet it was found necessary to keep men beating or tapping the bottoms of the screens with sticks to prevent clogging. Each screen ended in a short chute which led to a bin. The material was shoveled from these bins into carts and taken to the filter beds. It was impossible to get the bins on this gravel separator high enough to back carts under, on account of the extreme length and angle of the finer screens.

The top of the sand was finished 6 ins. higher in the center than on sides. To get the top to even grade, stakes were set with a level every 12 ft. along the sides of each individual filter, 4 ins. below grade, and on top of these was placed 1 × 4-in. strips. These strips, which were taken up after use, served as guides upon which to draw a form, which was 2 × 10 ins. by 15 ft. long, sawed out on the under edge to the form required.

The cobble stones used for paving the dams and gutters were all gathered out of the excavated material. The suction well is built of large cobbles, backed with rubble masonry. The filter was begun Feb. 1 and water turned in Aug. 1.

In addition to the information already given, the following items have been obtained by a representative of this journal during visits to the plant while it was under construction and since it was completed:

As will be seen by referring to the view, Fig. 35, there were three different screening stands. The screen at the left was used simply to take out as much sand as possible from the coarse material. The set of four screens in the middle was used to separate the gravel into the different grades desired, some sand not removed by the first screening passing through the last screen of this set. The screen at the left served the same purpose as the first one named, but instead of having meshes ⅛ × 2 ins., it had ⅛ × 6-in. meshes. It was used only when the sand was so wet or when the gravel formed so large a proportion of the material that the sand would not readily pass through the first screen.

In selecting the material for the upper, or filtering layer proper, sand which had passed the ⅛-in. sieve was placed to a stated depth in a small but deep tin cup, having a perforated false bottom. Another and smaller cup was filled with water, its contents poured upon the sand and the time required for the disappearance of the water observed. Sand which passed the water in from 1¼ to 2 minutes was considered satisfactory. Coarse sand passing the water in one minute was tempered with finer sand. Further than this no sand analyses were made. This method prevented too wide a variation in the size of the grains which would pass a ½-in. meshed screen. Otherwise there would have been absolutely no check but the eye upon the fineness of the material used. Without some means of securing an approach to uniformity it would be possible, as sands go, for one part of a bed to be of very fine and another of very coarse material, with corresponding differences in the rate of filtration, which would give unsatisfactory results.

The collecting drains were made of cypress and have a ¼-in. opening at their lower corner, blocks ¼ in. thick being inserted at intervals to keep the drain open. The drains were placed with their open part down to prevent the entrance of sand. The conduits leading from the drains to the gate house are of hemlock.

For washing the dirty sand removed from the surface of the beds an ingenious and what promises to be an economical and satisfactory arrangement has been devised. On top of each of the three banks dividing the filter beds is constructed a flume, shown in plan and section in Fig. 3. The flumes connect and lead to the space at the end of the beds next to the railway embankment. In cleaning a bed a movable flume will extend from the fixed flume out over the bed. The sand, as it is scraped up, will be shoveled into the movable flume. Water from a hose will be used to convey the sand through the movable and fixed flumes, and by the time it reaches the end of the latter it is calculated that it will have been thoroughly washed. At Poughkeepsie, N. Y., the sand has been, and perhaps still is, washed in a flume, but not until after its removal from the beds.

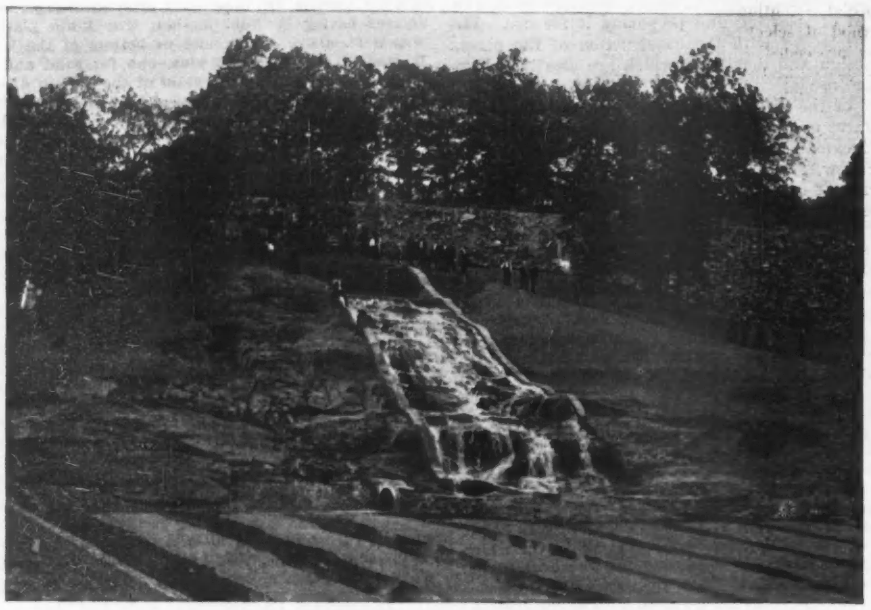


FIG. 36. VIEW SHOWING AERATING CASCADE AND ONE CORNER OF FILTER BEDS PARTLY COVERED WITH WATER.

The water comes by gravity to the receiving well at the head of the cascade through an 18-in. supply pipe 1½ miles in length. Water from the Pelhamville reservoir may also be admitted directly to the beds without aeration. At the foot of the cascade it passes along the breakwater and into the channel surrounding the beds, from which it passes into the depressions, spaced 15 ft. apart, between what Mr. Chester has termed the individual beds. By this means the water rises gradually over the beds, as at Lawrence (Eng. News, Aug. 3, 1893). At Lawrence a finer sand is used where the filtering material is shallowest, but at Mount Vernon the whole of the upper layer of sand, or filtering material proper, is of the same grade. At Lawrence, also, the several channels across the beds have paved gutters and the filtering sand is about 5 ft. deep over the drains, which are 30 ft. apart, and 3 ft. in the shallowest portions, while at Mount Vernon the gutters or channels are not paved and the filtering sand ranges from 1½ to 2 ft. in depth.

The total available filtering area at Mount Vernon is about 52,000 sq. ft., or somewhat less than 1¼ acres. A high rate of filtration is intended, as is evident from the coarseness and shallowness of the filtering material and the short distances apart of the collecting drains. The maximum water consumption is, so far as we can learn, less than 2,000,000 gallons per day. The cost of the beds, we regret to say, cannot be given here. The New York office of the New York City & Suburban Water Co., which owns the Mount Vernon Water-Works, is at 72 Broadway.

TECHNICAL EDUCATION.*

By Prof. De Volson Wood, M. Am. Soc. M. E.

We meet under auspices favorable and peculiar. Favorable because the antagonisms of the past between classical education and scientific education have passed away. There has been a surrender or a truce. Engineering education and abstract scientific education have become closely allied, and technical schools and scientific courses are no longer suppliants for favor at the hand of the traditional educator.

In less than 40 years, about 100 professional engineering schools, including special courses in universities, have come into existence in this country, graduating some 1,200 persons annually. Besides these, many of the other schools include some instruction in the mechanical arts and engineering subjects. This growth, spontaneous in its character, without a central head or mutual conference, furnishes a sufficient reason for the existence of this society. If its efforts are properly directed, it may make of all these schools a kind of university, in which, though widely separated, there may exist a bond of unity for accomplishing the best results in this line of education; in which there may be "unity in variety" as there will be "variety in unity."

Some things such a society cannot do, nor would it be best if it had the power. It cannot determine arbitrarily the number of schools nor the number of graduates. These will follow the law of supply and demand and can no more be fixed beforehand than can the political economist determine the proper number of lawyers, physicians, ministers, politicians, or any element of the body politic. It may be safely asserted that there is not a demand in the country for one thousand or more new professional engineers annually, but the fact that that number find useful employment, and that these schools are more and more crowded with applicants, shows that this kind of education is growing in popularity.

But all graduates do not follow the profession of their school for life's work. These schools have opened new lines of work, and raised the standing of others, as well as enlarged the field of engineering. Graduates are found in many, if not in all of the other learned professions, and in many departments of business. It therefore becomes doubly important that this education should be conducted on correct principles; that while the subjects for study are those of engineering, they should be so handled as to develop the mental powers. A cast iron course cannot be made, much less enforced. There must be a certain amount of flexibility; certainly, of personality.

Whatever subject be studied, whatever exercise be performed, whether in the lecture room, laboratory or shop, let there be research, an inquiring into facts, theory, law. If education be given for mere utilitarian grounds, if it is sought to transmute every formula, whether of mathematics, physics, chemistry or literature, into gold, education would not only degenerate but lose its power as an elevator of the intellect. Love of knowledge, for its own sake, is the highest motive for study. But the strife for place and early returns and the comparative poverty of many who seek professional life, tempt, if not force, them to take a lower standard. The very keynote of imparting knowledge is the use of the free inquiry, instead of the dogmatic method. The student should be led to discover truth as if it had not been discovered a thousand times before.

Apparatus cannot be a substitute for the live teacher, but is of great aid to him. A text-book in which the matter is well stated, well digested, well arranged and well printed, is one of the best pieces of apparatus for the learner. He will feel more confidence in the statements of an author than in notes taken from the utterances of a lecturer, and if in after years he has occasion to use the results sought, he will sooner turn to the book than to his lecture notes. Indeed, a text-book may be considered as a course of lectures printed after thorough revision. Lectures, however, should not be ignored or suppressed, but should supplement the text, where books of reference, periodicals and current literature may be brought to the attention of the student. Thirty or forty years ago there was a dearth of text-books in certain technics, but now there is such a multiplicity of them and such a desire to cover a large field, that there is a temptation to "cram." It is not the amount and variety of the viands put before the epicure, or the amount taken into the system, that makes bone, sinew and physical vigor, but that which is digested and assimilated. All are learners; and graduates, instructors and amateurs will find decided advantage in becoming members of one or more of the scientific and professional societies. Personal experiences, discussions and interchange of views are of great profit to all concerned. It is not the object of the school to make engineers, but to educate them. Engineers are born, not made. The man chooses his profession, the professor instructs; but no amount of school training will supply brains.

The teacher should enforce the importance of both accuracy and precision. The distinction between these is important. To illustrate, I will take an example in my own practice. I directed an assistant to set the transit over a certain stake and give the line. He did it with great precision, placing the bob exactly over the nail, leveling the plates very accurately, adjusting the eye and object glasses very nicely. Then I found that he had set the instrument over the wrong stake, two rods from the correct one. He was precise, but not accurate. Calculations are sometimes carried to many decimal places, giving the appearance of great precision, when from the nature of the case the data are imperfect.

Precision may or may not be truth; accuracy is truth. It is quite possible that the "what" and "how" herein set forth appear too reasonable to be questioned; but one need not go far to find that perpetual motionists and even believers in a flat earth are not extinct. Visionary theories are made on doubtful or even speculative grounds. Quack scientists are abroad. It belongs to the school to conserve the truth, and to correct processes of thought and investigation. The "how" consists largely in teaching the learner how to think, how to determine facts, how to test theories; and not, as the story runs, in regard to the theological professor when asked a question—"Young man, I wish you to understand you are not here to think, but to absorb."

Who shall teach? The instructor in engineering education should be one who loves to teach, who has a love for the truth and a fondness for his specialty, whose integrity is above suspicion, who has the necessary qualification, and who so assimilates knowledge that he will give something of himself to those he instructs. The instructor is fortunate who possesses personal magnetism, and when combined with a strong, pure character he exerts an unconscious power for good over his students. It is not necessary that the instructor should be an expert in the shop, the mine or the field; but a practical knowledge with the arts involved in any, or all these, better fits him for his duties. As a rule it is not desirable that a teacher of general engineering should be an expert in handicraft or be eminent in a specialty; for, however much he might desire to avoid it, he would be liable, unconsciously, to give undue prominence to his specialty to the subordination of other subjects equally, if not more, important.

Instructors should not be triflers. Sufficient time has been wasted over the question, "What would be the result of an irresistible force meeting an immovable body?" to gain a knowledge of Newton's three laws of motion. Be not enigmatical. Some profound writers have an ability of stating principles in such language as to require patient, prolonged, profound study to determine their hidden meaning. Such writing, though often of untold value to the science, should be translated and interpreted by the instructor before presenting the subject to the beginner. He should have a scholarly spirit. A love of knowledge, for its own sake, and not for commercial purposes, is the inspiring sentiment of the true student. He who discovers truth in this spirit is repaid by the joy experienced. If this love of learning be not possessed by the instructor, he cannot impart it to others.

* Condensed from the Presidential address before the Society for the Promotion of Engineering Education.

The possibilities of the future are great with hope, and the educated engineer is to be one of the important factors in the development of the resources of the world. Already the lives of individuals and the fortunes of men are at his disposal. "Time is money" in a more utilitarian sense than ever before.

The real question in this, as in all legitimate business, is not, how shall waste be reduced to the smallest amount, but rather how shall the highest efficiency be secured when all the elements involved are taken into account? For instance, the least waste on a railroad might be secured by letting the plant stand idle, for then there would be no expense for labor, fuel, wear and tear or accidents, and the deterioration might be less than when in operation; but, on the other hand, there would be no earnings. Waste accompanies profit. The naval battles of the present are fought by the engineer. The Yankee cheese box on a raft revolutionizes systems of warfare. It is now the battle of the metals. The success of land battles may yet depend more upon the skill of the engineer than upon the number slain. Rapid communication and construction have done much in alleviating the distress of those who carry arms in this most horrible method of settling disputes. But the greatest monuments to the engineer are in the arts of peace. The combination of the engineer, the inventor and the capitalist in the production of canals, railroads, the extraction of metals, transportation by steam, the application of electricity, agricultural implements, sanitary improvements and of numerous labor-saving machines are modifying the habits and customs of society and producing a greater revolution than the armies of a conqueror. The labor-saving machine is also labor-making. It not only opens a new line of manufacture, but furnishes new fields of labor for those displaced. It forces a redistribution of labor. It may increase the number of mechanics, shippers, salesmen, clerks, officials and promoters of new enterprises, or it may increase some of those and diminish others; but so complex are these changes that no lynx-eyed observer can trace their bewildering paths. These energies give increased power to those who direct them. In the hands of the beneficent they increase comfort and blessing; in the hands of the selfish and designing, misery and degradation. Education elevates. It is the province of the engineer to harness the forces of nature and make them serve the interests of man. With increased facilities for storing and transmitting energy, wind, water falls and tides will be made more useful in supplying power, light and heat where desired. Thus the scientific method is working itself out in various directions, and it is the province of this society to consider the means of promoting that education which shall be best for those who are to labor in this sphere of life's work.

CONSTRUCTION NEWS.

RAILWAYS.

East of Chicago—Existing Roads.

ATTICA & FREEDOM.—The purchase of this narrow gage road by S. S. Bullis, Olean, N. Y., was noted in our issue of Aug. 2. Press reports state that the work of rebuilding it is being rapidly pushed, and that the name will be changed to the Buffalo, Attica & Arcada. W. G. Conklin, Bradford, Gen. Man., is in charge of the work.

BEECH CREEK.—It is stated that this road will soon be extended from Mehaffy, Clearfield county, Pa., to a connection with the Pittsburg, McKeesport & Youghiogheny, on the Youghiogheny River. Ch. Engr., John B. McIntyre, Jersey Shore, Pa.

BELLEFONTE CENTRAL.—The right of way is being cleared for an extension from State College to Pine Grove Mills, Pa., a distance of six miles.

DUNKIRK, ALLEGHENY VALLEY & PITTSBURG.—Press reports state that this road will probably be extended in the near future from Warren, Pa., about 60 miles into the Jefferson county soft coal fields. The road is a part of the New York Central system.

FORT WAYNE & EASTERN.—This company was incorporated in March to build a railway from Baldwin, Ind., to Fort Wayne, 20 miles, and it is now reported that the line is graded within four miles of Fort Wayne and track laid to within 13 miles. It is proposed to extend the line to Findlay, O., and the contract for the work to the Ohio state line is said to have been awarded to a Dayton, O., firm. Lucius H. Beers, 120 Broadway, New York, was one of the incorporators.

PENNSYLVANIA MIDLAND.—P. W. Avirett, Supt., is reported as stating that the company will construct a railway to Portland, Pa., a distance of 110 miles from Harrisburg, having acquired the route of the Pennsylvania, Portland, Poughkeepsie & Boston between Slatington and Portland. There will also be a branch of 19 miles from Strausstown to Reading. Connections will be made with the Pennsylvania in Harrisburg and in Reading, and with the Delaware, Lackawanna & Western in Portland. The ultimate object is to complete the line to Springfield, Mass., using the oft-surveyed South Mountain & Boston, which gives a route from Harrisburg to Boston, 140 odd miles shorter than any other. E. A. Tennis, who is building a portion of the road, has awarded subcontracts as follows: 70-lb. steel rails, Bethlehem Iron Co.; 14 iron bridges, Edgemoor Bridge Co.; frogs and switches, Wharton Frog & Switch Co.; nut locks, National Nut Lock Co.; cars, Harlan & Hollingsworth Co.; locomotives, Baldwin Locomotive Wks.

Southern—Existing Roads.

YAZOO & MISSISSIPPI VALLEY.—This road has been changed to standard gage between Jackson and Natchez, Miss., 99 miles. The work was completed Aug. 12. The road is a part of the Illinois Central system.

Projects and Surveys.

OHIO RIVER & CHARLESTON.—Incorporated in Kentucky to build a railway from Ashland to Louisa; capital stock, $50,000. Col. Walter Evans, Louisville, is one of the incorporators.

Southwest—Existing Roads.

GULF, BEAUMONT & KANSAS CITY.—Snyder & Hanson, Beaumont, Tex., have been awarded a contract for the construction of a 15-mile extension, beginning at Bena, in Jasper county, Tex., and extending northward on the line of Jasper and Newton counties.

Rocky Mt. and Pacific—Existing Roads.

EVERETT & MONTE CRISTO.—It is stated that $75,000 of improvements have been authorized on this short road in Washington. Pres., Geo. S. Brown, Everett, Wash.

Projects and Surveys.

COLORADO.—A press report from Denver, Colo., states as follows: It is announced that Boston capitalists are about to organize a company to build a railway from Pueblo to Trinidad which will be leased to the Union Pacific, Denver & Gulf, at a price equal to 10% on the investment. This company now uses the Denver & Rio Grande tracks between those points, paying a rental of $180,000 a year. The new road, it is said, can be built for $800,000.

Foreign.

CARTAGENA-MAGDALENA.—This railway in Colombia was formally opened for traffic July 29. It is an American enterprise and extends to the town of Calomar, on the Magdalena River. It is reported as 60 miles in length and is expected to revive the former commercial importance of Cartagena, which is said to have one of the best harbors on the South American coast.

OAHU RY. & LAND CO.—C. H. Kluegel, Ch. Engr., Honolulu, writes us as follows concerning this railway, noted last week: The Oahu Ry. & Land Co. was incorporated in 1880. It obtained a 50-year lease of several large tracts of land and purchased others. On this land two sugar plantations have been established whose present product is 12,000 tons of sugar per year. Pearl City has been laid out, occupying a peninsula in Pearl Harbor and some higher ground. Most of the land is still used for grazing. In 1889 and 1890 the railway was built from the company's wharf in Honolulu westerly to the Ewa sugar plantation, a distance of 19 miles. The principal freights are sugar, coal, rice and bananas. The coal is used mostly for running irrigation pumps. Large phosphate and fertilizer works are being built on the line of the railway. Preliminary surveys were made in 1891 for extending the railway, but the financial and political disturbances delayed construction. Under a contract between the company and A. Feek, of Seattle, Wash., work has been begun on an extension to Kahuku, a distance of 52 miles, which will probably be completed in 1895. The line runs along the west shore of the island of Oahu most of the distance. The grading will be light except on 15 miles of steep rock slopes. B. F. Dillingham, Gen. Man., has been the promoter of this enterprise and has overcome many difficulties.

STREET AND ELECTRIC RAILWAYS.

MILTON, MASS.—The Milton & Boston St. Ry. Co. is being formed with a capital stock of $50,000 to construct an electric railway from East Milton to Mattapan. The completion of this line and the proposed extension of the Quincy & Boston R. R., from West Quincy to East Milton, will make a continuous line from East Weymouth to Boston. The following persons are interested: A. A. Brackett, J. R. Lawrence, Milton; J. A. Duggan, W. P. Pinel, Quincy.

WORCESTER, MASS.—A company is being formed with a capital stock of $100,000, to apply for a franchise for an electric railway about five miles in length. G. F. Brooks, Boston, and Edwin Buxton, Worcester, are interested.

LOCKPORT, N. Y.—The Lockport City & Olcutt Electric R. R. Co. has been incorporated to construct an electric railway 20 miles long; capital stock, $200,000; directors, W. T. Holt, M. E. Stone, J. L. Toch, Noel Gale, New York.

SYRACUSE, N. Y.—The Syracuse, Eastwood Heights & De Witt R. R. Co. has been granted a franchise to extend its electric railway.

RUTHERFORD, N. J.—The council is discussing a petition, presented by D. E. Culver, for the construction of an electric railway from this place to Newark.

SOUTH ORANGE, N.J.—The South Orange & Maplewood St. Ry. Co. has been incorporated with a capital stock of $100,000, by H. A. Page, S. H. Howe, South Orange; W. P. Jameson, Frank Brewer, West Orange; and W. M. Haines, Englewood.

MEDIA, PA.—Surveys are being made for the Media, Middletown, Aston & Chester Electric Ry.

POTTSTOWN, PA.—Surveys are being made for an extension of the Pottstown Passenger Ry. to Royersford, a distance of 4½ miles.—It is reported that the Norristown Passenger Ry. Co. will extend its electric line to Royersford, and that when this is completed, an electric railway will connect Conshohocken with this city.

ANNAPOLIS, MD.—The Annapolis, Bay Ridge & Brighton Beach Electric Ry. Co. has been incorporated by T. C. Musgrove, Philadelphia; L. H. Rehn, J. H. Vansant, D. J. Saunders.

KENSINGTON, MD.—The citizens of this place and vicinity have subscribed $12,000 to secure the construction of the Chevy Chase & Kensington Electric Ry. T. R. Martin and J. H. Fishback are interested.

CHARLESTON, S. C.—The council has been petitioned for a franchise for an electric street railway.

DE LAND, FLA.—J. B. Stetson has proposed that an electric railway be constructed from Beresford to Lake Helen, through this place.

NASHVILLE, TENN.—It is reported that arrangements are being made to extend the Buena Vista St. Ry.

MANCHESTER, O.—It is reported that an electric railway is to be constructed from this place to West Union, a distance of ten miles. Frank E. Holliday, New York, is interested.

TOLEDO, O.—The Maumee Electric Ry. Co. has secured the right of way to extend its line between Perrysburg, Maumee and this city, for which the contract has been awarded. Pres., Parks Foster.

WYOMING, O.—The citizens' committee has been investigating the feasibility of the proposed electric railway on the Paddock Road and has recommended that bids be advertised for the construction. W. M. Bateman, Glendale, and A. J. Marsh, Hartwell, are said to be interested.

YOUNGSTOWN, O.—The Youngstown Park & Falls St. Ry. Co. has been granted a franchise to construct a line to be operated either by compressed air or electricity.

CHICAGO, ILL.—The Chicago, Oak Park & Harlem St. Ry. Co. has been incorporated to construct an electric railway, with a capital stock of $50,000, by J. C. Schumacher, John Guaedinger and Frank Froost.—L. C. Bonney, Secy. Chicago General Ry. Co., is reported to have stated that the company will soon build a crosstown railway.

SIOUX CITY, IA.—Press reports state that O. A. Goodrich, New York, and A. Holmes, John Pierce, H. A. Johns and E. C. Peters have organized the Sioux City & Suburban St. Ry. Co. with a capital stock of $1,000,000, for the purpose of consolidating all the street railways of this place. They now have the Riverside Park line, the South Sioux City & Covington road, the Short Bridge line, the Jackson St. line and the Sioux City & Leeds line, all electric roads. They still want the Sioux City Traction Co.'s line, with 30 miles of track, and the Morning Side line.

ATCHISON, KAN.—The Atchison Ry., Electric Light & Power Co. has been incorporated; capital stock, $500,000; directors, W. P. Waggener, Ellsworth Ingalls, C. S. Hetherington, S. E. Harburger, Atchison, and H. A. Odell, Geo. W. Riggs, A. E. Cullingworth, Chicago.

JOPLIN, MO.—The Joplin Electric Ry. Co. has proposed to extend its line to Galena, Kan., a distance of eight miles.

LITTLE ROCK, ARK.—H. F. Auten, E. E. Noss and Otis Fuller have petitioned the council for a 30-year franchise for an electric railway.

COLLINWOOD, ONT.—Arthur Stephen is about to construct a short line in this place.

HIGHWAYS.

NEW JERSEY.—Bids are asked until Aug. 27 for furnishing crushed stone for repairing telford pavement in six avenues in Essex county. John O'Hogan, Jr., Clk., U. S. Credit Bldg., Newark.

BRIDGES AND TUNNELS.

CONCORD, N. H.—The council has voted to build a new steel bridge 200 ft. long over the Contoocook River, the cost not to exceed $10,500.—Bids are asked until Sept. 6 for constructing a bridge, as stated in our advertising columns. W. B. Howe, Cy. Engr.

CHESTER, PA.—Press reports state that the Philadelphia, Wilmington & Baltimore R. R. engineers are making plans for a new iron bridge over Chester Creek in this city. It will have a 125-ft. span and cost about $50,000.

NEW ORLEANS, LA.—It is stated that bids will soon be received for constructing several small iron bridges.

CINCINNATI, O.—Bids are asked by the commissioners of Hamilton county until Aug. 29 for the purchase of $58,000 of 4½ 7-year bridge bonds.—The engineer has reported that a steel viaduct over Shields St., with a 36-ft. roadway and 10-ft. sidewalks, would cost, $95,400.

CLEVELAND, O.—The contract for the superstructure of the Jefferson St. bridge has been awarded to the King Bridge Co., at $3,519. The bids were as follows: King Bridge Co., $3,519; Detroit Bridge & Iron Wks., $4,074; Variety Iron Wks., $4,143; Wrought Iron Bridge Co., $4,258; Massillon Bridge Co., $4,470; Youngstown Bridge Co., $4,430; Pennsylvania Bridge Co., $4,445; James Ritchie, $4,500; New Columbus Bridge Co., $5,009; Rochester Bridge Wks., $5,036; Champion Bridge Co., $6,015; Canton Bridge Co., $5,250.

DAYTON, O.—Bids are asked until Sept. 17 for the construction of an iron hoist bridge across the Miami and Erie canal at Warren St. C. A. Herbig, Cy. Comptroller.

INDIANAPOLIS, IND.—Bids are asked by the county commissioners until Sept. 29 for the construction of a bridge over White River, for which it is reported that $25,000 has been appropriated.

WATERLOO, IND.—A traction engine broke through a bridge one mile south of this city Aug. 10, fatally injuring two persons.

JOLIET, ILL.—Bids are asked until Aug. 27 for constructing 130, 50 and 37-ft. clear steel bridges; also for repairing one bridge. Cy. Engr., O. R. Ranchfuss; Cy. Clk., S. C. Rickson.

YANKTON, S. DAK.—Bids are asked by the county commissioners until Sept. 3 for the construction of two wooden bridges.

SAN DIEGO, TEX.—Four railway bridges on the line to Laredo were recently washed away.

OAKLAND, CAL.—The contract for constructing the Polasco bridge has been awarded by the supervisors to Cotton Bros., at $4,690.

SACRAMENTO, CAL.—Bids are asked until Aug. 30 for plans, specifications, etc., for a county bridge across the Cosumnes River. W. B. Hamilton, Clk. Supervisors.

WATER-WORKS.

HALLOWELL, ME.—Ben Tenney and G. B. McClench are members of a committee investigating the question of works.

GROVETON, N. H.—It is stated that the town will purchase the works for $35,000, the company to build a reservoir and put in 33 hydrants. G. B. Hinman and F. W. McDonald are interested.

DODGEVILLE, MASS.—The Fall River "News" states that the laying of four miles of pipe to supply this place and Hebronville will be commenced this week.

MEDWAY, MASS.—The construction of works will be commenced as soon as a location for a supply has been decided upon, according to reports.

MILLERS FALLS, MASS.—Plans are being consid-

ered for securing a supply from Lake Pleasant for fire protection.

NORTH ATTLEBORO, MASS.—P. M. Blake, Engr., Hyde Park, has advised against sinking an additional well and in favor of a supply from Fuller's Pond. This would also supply Plainville, a suburb of the town.

ALBANY, N. Y.—The contract for laying the foundation for the new pump has been awarded to Cassidy & Gallagher, Albany, at $19,500. Hilt & McCann bid $19,981.

AMITYVILLE, N.Y.—The contract for extending the mains has been awarded to John Lockwood, Jamaica.

CANANDAIGUA, N. Y.—A meeting was held Aug. 17 to consider the advisability of advertising for bids for new works, the present service being unsatisfactory, and an increase in rate of 25% being demanded after Sept. 1. The citizens voted to secure estimates for new works and to find out at what price the present plant could be purchased.

DUNDEE, N.Y.—There is talk of constructing works.

HAMILTON, N. Y.—Bids are asked until Sept. 6 for constructing works, as stated in our advertising columns. Engrs. Stanwix Engineering Co., Rome. B. J. Stimpson, Village Clk.

HAMMONDSPORT, N. Y.—W. F. Randall, Syracuse, is reported to have prepared plans for works at this place.

JOHNSTOWN, N. Y.—The citizens have voted 259 to 221 against appropriating $140,000 for works.

TONAWANDA, N. Y.—Bids are asked until Sept. 7 for building intake pier in the Niagara River, as stated in our proposal columns. Village Engr., J. B. Snow; D. Kohler, Jr., Secy.

ARLINGTON, N. J.—The East Jersey Water Co. has offered to supply the township of Kearney with Acquackanock water at $100 per million gallons, or at $90 if the daily supply exceeds 400,000 gallons.——It is stated that this company is about to build a dam 60 ft. high and 400 ft. in length near Split Rock Pond.

AVALON, PA.—E. G. Caughey, C. L. McIntyre and others have organized the Riverview Water Co. to supply this place.

BEDFORD SPRINGS, PA.—James H. Harlow & Co., Pittsburg, have been engaged as engineers on a supply at this place.

CORRY, PA.—The council is considering the proposition of C. H. Wetmore, noted Aug. 2, whereby works and an electric light plant will be put in and become the property of the city after 21 years, the annual cost to be $10,468. C. B. Porter, Cy. Clk.

GALETON, PA.—It is reported that a company is being organized, with a capital stock of $8,000, to put in works.

GORDON, PA.—The Citizens' Water Co. has been incorporated by citizens and purchased the stock of the Hadesty Water Co. Extensions and improvements are contemplated.

HALIFAX, PA.—The council is reported as in favor of works; supply from springs four miles distant.

NEW CASTLE, PA.—The water company is reported about to make extensions to cost $15,000, and other improvements, at a total cost of $50,000.

NEW OXFORD, PA.—The citizens are making arrangements to put in works, according to reports.

READING, PA.—A new reservoir is to be constructed to supply the higher parts of the city.

SINKING SPRINGS, PA.—The Sinking Springs Water Co. has been incorporated with a capital stock of $10,000; Treas., Samuel B. Keppel.

TROUT RUN, PA.—W. L. Coover, Duncannon, Secy. Trout Run Water Co., writes us that S. W. Cooper, Millersburg, is preparing plans for a gravity plant. A dam will be built and all the work probably done by day labor.

GRAFTON, W. VA.—The contract for works has been awarded to Bennett & Talbott, Greensburg, Pa., at $32,327.

NEW MARTINSVILLE, W. VA.—E. J. Millar, Steubenville, O., is preparing plans for works.

RONCEVERTE, W. VA.—Bids will soon be asked for constructing works, according to reports.

TITUSVILLE, FLA.—J. Francis Le Baron, Jacksonville, has prepared plans for works to cost $15,544, and the city has granted a 50-year franchise to parties who are expected to commence the construction at an early date; works will include a gang of driven wells, a 20 x 20-ft. iron stand-pipe on a steel tower 98 ft. high, a 25-ft. windmill, steam pump and boiler, and two miles of 12 to 3-in. distribution pipe.

GREENVILLE, MISS.—Bids are asked until Oct. 2 for building works upon the franchise plan, as stated in our advertising columns. Address the city clerk.

OXFORD, MISS.—Bids will soon be asked for works, including five miles of mains, pumping engines, stand-pipe, etc.; supply from springs. E. O. Davidson, Cy. Clk.

WATER VALLEY, MISS.—The city council is reported as negotiating $20,000 in bonds for works and sewers.

HUMBOLDT, TENN.—The contract for works is said to have been awarded to G. C. Anderson & Co., Jackson.

PINEVILLE, KY.—The plant of the Pineville Water Co. is reported as to be sold shortly by order of court.

BRADNER, O.—It is reported that the council has contracted for new works.

CARTHAGE, O.—An election will be held Aug. 27 to vote on an issue of $15,000 in 6% bonds for a reservoir and extensions. L. Hall, Village Clk.

DECATUR, IND.—The council has contracted with Kerlin Bros., Toledo, to put in works to cost $45,000, according to reports.

HARTFORD CITY, IND.—Roll Manor, Cy. Clk., writes us that the contract for works has been awarded to the Boughen Engineering Co., Cincinnati.

LIBERTY, IND.—The citizens have voted in favor of works.

QUINCY, MICH.—Bids are asked until Sept. 5 for constructing works, as stated in our proposal columns. Consult. Engr., W. S. Parker, Pontiac, Mich. J. B. Vaunasdale, Clk.

CHICAGO, ILL.—Bids are asked until Aug. 28 for laying service pipes in 11 streets. H. J. Jones, Comr. Pub. Wks.——Osborne & Smalley bid $1.10 per lin. ft. and W. H. Gray & Bro., 75 cts. for making borings and soundings for the location of the proposed new northwest land tunnel from the Chicago Ave. pumping station. This work will cost about $6,000.

HOMER, ILL.—The proposition to secure works at a cost of $5,000 was defeated by one vote, and it is thought probable that another election will soon be held.

LEXINGTON, ILL.—The council has voted to issue $7,000 in bonds for works. A. B. Davidson, Cy. Clk.

LINCOLN, NEB.—The "Courier" urges that new works be built by the city.

MORRIS, ILL.—Press reports state that over 20 bids were received for constructing works, the successful bidders being the Harvey Boiler Wks., Harvey, Ill., pumping machinery, stand-pipe, etc., $7,525; Snyder & Williams, Dayton, O., pipe, pipelaying, etc., $17,443; C. & T. Inglehart, Morgan Park, Ill., pumping station, etc., $2,834.

NOKOMIS, ILL.—A supply has been secured from wells, and it is stated that works will be put in at once.

TONICA, ILL.—The question of works is being investigated; supply from springs.

TURNER, ILL.—C. D. Clark and A. H. Fairbanks are members of a committee that is circulating a petition for works.

VANDALIA, ILL.—The citizens have voted, 365 to 100, in favor of works.

WELDON, ILL.—The business men are reported as investigating the cost of works.

AMERY, WIS.—It is stated that $3,000 will be spent for works.

COLUMBUS, WIS.—The citizens are considering the question of putting in works; estimated cost, $20,000.

CUMBERLAND, WIS.—The citizens have voted to issue $6,000 in bonds toward constructing works; estimated cost, $8,000.

LODI, WIS.—An election was held Aug. 22 to vote on an issue of $12,000 in bonds for works. No plans have yet been prepared. S. H. Watson, Clk.

MILWAUKEE, WIS.—J. A. B. Tompkins,, Engr., has reported that it will cost $47,134 to extend the mains to Wanwatosa.——For two submerged cribs, for which bids were opened Aug. 17, Wm. Forrestal bid $11,320, and C. H. Starke, $13,000.

SOUTH MILWAUKEE, WIS.—Bids for the erection of a stand-pipe have been authorized by the village board.

TOMAHAWK, WIS.—Bids are asked until Sept. 1 for a 4-in. extension, including one hydrant. Chas. A. Ayer, Cy. Clk.

WAUPUN, WIS.—An election will be held Sept. 18 to vote on an issue of bonds for works.

CLARKSVILLE, IA.—Plans and specifications have been prepared for works to cost $6,000 to $8,000, and an election will soon be held to vote on the question.

DEXTER, IA.—An election will probably be held soon to vote on an issue of $6,000 to $8,000 in bonds for works. C. C. Pugh, Mayor.

DAYTON, IA.—The citizens have voted to issue bonds for works.

EARLHAM, IA.—A well is being sunk for fire protection and there is talk of putting in works.

GUTTENBERG, IA.—Bids are asked until Sept. 18 for constructing works, as stated in our proposal columns. H. C. Eckart, Recdr.

OAKLAND, IA.—The contract for works has been awarded to the U. S. Supply Co., Omaha, at $4,220. The work will include a 10 x 50-ft. steel tank on a concrete foundation, and three wells. The Iowa Mfg. & Construction Co., Sioux City, bid $4,910. Engr., F. L. Burrell, Fremont, Neb.

SPRINGVILLE, IA.—Only two votes were cast at the election Aug. 13 against granting a franchise to the company recently organized to put in works.

TRAER, IA.—Bids are asked until Sept. 3 for constructing works. W. J. Ladd, Recdr.

FULDA, MINN.—Bids are asked until Aug. 25 for the purchase of $10,000 in water bonds. J. A. Maxwell, Recdr.

WELLS, MINN.—Bids are asked until Sept. 1 for the purchase of $20,000 in 5% 20-year water and light bonds. A. O. Olson, Cy. Recdr.

BLAIR, NEB.—The contract for pumping engines, boiler, etc., as recently advertised, has been awarded to Fairbanks, Morse & Co., Omaha, at $4,789. Engr., F. L. Burrell, Fremont, Neb.

FIRTH, NEB.—The citizens have voted to issue bonds for works.

SYRACUSE, NEB.—Bids are asked until Sept. 6 for constructing works; also for the purchase of $10,500 in 6% water bonds. Consult. Engr., A. A. Richardson, Lincoln, Address the city clerk.

GRAND FORKS, N. DAK.—The city has sold $40,000 in 6% bonds for the construction of the proposed filter plant.

PRESCOTT, ARK.—Steps are being taken to secure works, according to reports.

OAK CLIFF, TEX.—The contract for constructing works has been awarded to O. J. Gorman, Dallas, at $13,390 for the work complete. J. M. Carter, Abilene, bids $15,500, and W. E. DeLong, Bastrop, $15,998. An artesian supply has been secured at a depth of 740 ft. Engr., J. S. Thatcher, Dallas.

CRIPPLE CREEK, COLO.—E. J. Eaton and others of Colorado Springs have petitioned for a franchise for works, estimated to cost $60,000.

EVERETT, WASH.—Ellis Morrison has been granted an extension of 90 days on the franchise for works.

CASCADE LOCKS, ORE.—The Cascade Water Co. has been incorporated with a capital stock of $15,000.

COTTAGE GROVE, ORE.—J. G. Kelly, Eugene, is reported to have contracted to put in works to cost about $5,000.

INDEPENDENCE, ORE.—The Gilmore Water & Electric Light Co. has been incorporated with a capital stock of $30,000 to supply water and light to this place and Monmouth.

TUCSON, ARIZ.—Mr. Hilsinger has applied for a franchise for works.

SUDBURY, ONT.—The citizens have voted to issue bonds for water-works, estimated to cost $30,000, electric lights and sewers, $10,000.

IRRIGATION.

ENTERPRISE, KAN.—A press report states that Hon. C. B. Hoffman, of Topolobampo fame, is having surveys made for the largest irrigation plant in Central Kansas.

GERING, NEB.—The Gering Canal Co. was organized Aug. 16 to build an irrigation canal 60 miles in length.

GRANT, NEB.—The residents of this county have voted to issue $90,000 in bonds to aid in the construction of an irrigation and power canal.

HOLDREGE, NEB.—J. L. Rhea, and J. E. Nelson are members of a committee appointed to engage an engineer to make surveys for an irrigation ditch in this county, and L. J. Titus and W. H. Paddock to negotiate the bonds.

LOUP CITY, NEB.—The Sherman County Irrigation, Water Power & Improvement Co. is reported as arranging to construct a ditch 65 ft. wide and 35 miles in length. Pres., C. L. Drake; Secy., W. R. Mellor; Treas., R. J. Nightingale.

SAN SABA, TEX.—The San Saba Valley Irrigation Co. has filed with the county clerk the contract for the irrigation of 40,000 acres of land in the San Saba Valley. The work will require the construction of 134 miles of canals and is to be commenced within 60 days, according to a press report.

WINCHESTER, CAL.—Bids are asked until Sept. 4 for sinking shafts, excavating canal, boring wells, furnishing vitrified or cement pipe, also cement, etc. P. Milliken, Secy., San Jacinto & Pleasant Valley Irrigation District.

NEW COMPANIES.—Agricultural Development Co., Jersey City, N. J.; $250,000; to operate in Mexico, Mex., and state of New York; to construct reservoirs, ditches, etc.; John B. Frisbie and L. P. Frisbie, Mexico, Mex.; J. Milton Ferry, Bayonne, N. J.——Farmers' & Merchants' Irrigation & Land Co., North Platte, Neb.; $50,000; W. L. Park, C. McDonald, C. F. Iddings, W. Baker and others.——Farmers' Irrigation Co., Lexington, Neb.; $6,000; Thomas Maher, C. Kjar, Martin Peterson, W. H. Potter.——Farmers' & Mechanics' Irrigation Co., Lexington, Neb.; $25,000; Anton Abel, H. V. Temple, L. B. Smith, T. J. Rosenberg, Albert Able.——Burwell Irrigation Co., Burwell, Neb.; $50,000; to construct a ditch 20 miles in length.——Dry Gulch Ditch & Irrigation Co., New Bridge, Ore.; $4,000; A. R. Stalker, H. J. Fuller, R. H. Boyles, C. B. Leep, and others.——Farmers' Union Ditch Co.; $50,000; to operate in Boise Valley, Idaho; S. S. Foote, P. S. Palmer, J. G. Camp, W. J. Flake.——Battlement Mesa Ditch & Reservoir Co., Delta, Colo.; $6,000.

SEWERS.

ROCHESTER, N. H.—The contract for constructing sewers, as recently advertised, has been awarded to Morgan & Booth, Trenton, N. J., at $11,588. The detailed bids will be published in a later issue. Engr., Ernest W. Bowditch, Boston.

ATTLEBORO, MASS.—It is stated that the city will construct a new system, adopting sewage disposal by filtration.

BOSTON, MASS.—The following bids were received by the metropolitan sewerage commission Aug. 11 for a sewage pumping station at Charlestown:

Edward Lynch & Co., Boston	$17,549
Woodbury & Leighton, 166 Devonshire St., Boston	17,900
Mack & Moore, Boston	19,000
Thomas Bros. & Co., Turners Falls, Mass.	19,435
Kelley & McKinnon, 166 Devonshire St., Boston	19,600
Walter S. Sampson, 53 State St., Boston	19,784
Donahue Bros., Boston	20,500
Kerrans Driscoll, 17 Otis St., Boston	20,735
E. E. Strout, Lynn, Mass.	20,970
W. L. Clark & Co., 166 Devonshire St., Boston	21,019
John McDonald & Son, Cambridge	21,201
Gooch & Pray, Boston	23,300
Norcross Bros., Boston	23,952
Jones & Meehan, Jamaica Plain	24,175
William T. Eaton, South Boston	24,336
Henry Mellen & Son, Worcester,	25,334

CAMBRIDGE, MASS.—The following bids were received for constructing the proposed inverted syphon: W. L. Miller, $6,982; Fallow & Cronin, $8,118; National Construction Co., $13,300. Cy. Engr., L. M. Hastings.

WOONSOCKET, R. I.—The council and commissioners are discussing the question of appropriating $50,000 for constructing sewers.

BUFFALO, N. Y.—The following bids have been received for constructing a sewer in Pleasant Ave: John Mumm, $7,055; Harrar & Hess, $7,754; Elmer Mighton, $8,290; Jacob Ritzman, $8,333; Henry Harter, $8,342; J. C. Green, $8,598; Andrew Ignatz, $8,920; F. J. Martin, $8,965; Henry Kebbin, $9,030.

DUNKIRK, N. Y.—It is reported that this city will spend $60,000 for constructing sewers.

NORTH TARRYTOWN, N. Y.—Plans have been completed for a system, and an election was held Aug. 21 to vote on appropriating $28,000 for construction.

SYRACUSE, N. Y.—The city clerk has been directed to advertise for bids for constructing 15-in. pipe sewers in three streets.——The city engineer has recommended that 15 and 12-in. pipe sewers be constructed in three streets, and has estimated the cost of constructing 48 and 24-in. brick sewers in two streets at $11,200.

BLOOMFIELD, N. J.—Bids are asked until Aug. 27 for constructing 11 miles of pipe sewers, as stated in our advertising columns. Engr., A. H. Olmstead. W. L. Johnson, Clk.

BOUND BROOK, N. J.—Bids are asked until Sept. 4 for constructing 24,221 ft. of 20 to 8-in. pipe sewers, as stated in our advertising columns. H. M. Herbert, Borough Engr. F. N. Voorhees, Borough Clk.

PLAINFIELD, N. J.—Bids are asked until Sept. 5 for constructing 27,455 ft. of 24 to 8-in. pipe sewers, as stated in our advertising columns (postponement from Aug. 21). J. T. MacMurray, Cy. Clk.

PARSONS, W. VA.—The citizens on Sept. 1 will vote on the question of bonding the town for $3,000 for a system and for street improvements.

SANDUSKY, O.—The following bids have been received for constructing sewers:

	Meigs St. 4,500 ft.	Madison St. 5,000 ft.
John McKean	$4,577	$9,038
McKean & Callen	4,856	8,093
Patrick Martin	4,890	6,682
C. F. Hartman	5,156	8,168
James Conley	5,806	9,732

DAYTON, O.—Bids are asked until Aug. 30 for constructing a sewer in Webster St. C. A. Herbig, Cy. Comptroller.

HAMILTON, O.—The contract with McNerney & Davis, for constructing pipe sewers in district No. 1, at $29,893, has been rescinded and the council will readvertise for bids for the construction.

ALTON, ILL.—The council has voted to extend the sewer in Piasa St.

CHICAGO, ILL.—Bids are asked until Aug. 28 for constructing sewers; 45 contracts. H. J. Jones, Comr. Pub. Wks.——The Western Sewer Pipe Co., has been incorporated with a capital stock of $10,000, by R. C. Hall, R. E. Spangler and J. J. Bates.

MARINETTE, WIS.—It is reported that this place will spend $100,000 for sewers, paving and other public improvements.

MINNEAPOLIS, MINN.—The committee has recommended the construction of a 56-in. sewer in 14th St. estimated to cost $52,000.——The council has passed ordinances for constructing 15 and 12-in. pipe sewers in 11 streets and 51 to 24-in. brick sewers in 23 streets. C. F. Haney, Cy. Clk.

FORT DODGE, IA.—Bids are asked until Aug. 27 for constructing 3,886 ft. of 12 to 10-in. pipe sewers. D. A. Weller, Cy. Clk.

OMAHA, NEB.—The city engineer has made plans for constructing sewers; estimated cost, $13,375.

ST. LOUIS, MO.—Bids are asked until Aug. 28 for constructing 8,300 ft. of 87 to 27-in. brick, and about 11,470 ft. of 24 to 12-in. pipe sewers. E. S. Foster, Secy. Bd. Pub. Impvts.

TAYLOR, TEX.—It is proposed to construct about three miles of sewers, estimated to cost $10,000, according to reports.

AUBURN, CAL.—It is reported that the citizens are discussing the construction of a system.

BERKELEY, CAL.—The trustees are discussing the construction of 10,700 ft. of 16 to 10-in. pipe sewers. Engr., C. L. Huggins.

LOS ANGELES, CAL.—Plans are being made by the city engineer for a sewer district half a mile square.

OAKLAND, CAL.—The city engineer has completed plans for sewers estimated to cost $30,000.

TORONTO, ONT.—It is proposed to construct a sewer in Preston Ave.; estimated cost, $6,000.

STREETS.

BOSTON, MASS.—The park commissioners are reported about to macadamize Commonwealth Ave. from Arlington St. to Massachusetts Ave.

CAMBRIDGE, MASS.—The aldermen have appropriated $11,000 to finish paving Western Ave. with granite.

PROVIDENCE, R. I.—Bids are asked until Aug. 25 for grading River Ave. and macadamizing Smith St. in North Providence. W. C. Bourn, Town Clk.

BROOKLYN, N. Y.—Bids are asked until Aug. 29 for paving 21st street with cobblestones, and until Sept. 4 for flagging sidewalks, 23 contracts. A. T. White, Comr. Cy. Wks.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements of 23d and 24th wards, 2622 Third Ave., until Sept. 7, for paving 137th St. with trap blocks, and grading, curbing, etc., in two streets.

YONKERS, N. Y.—Contracts for paving have been awarded as follows: Barber Asphalt Paving Co., $24,824; F. H. Merritt, $6,484; Brendlinger & Nearing, $7,130.

TROY, N. Y.—Bids are asked until Aug. 28 for paving three streets with brick on concrete. E. O. Ross, Secy.

JERSEY CITY, N. J.—Bids are asked until Aug. 27 for 2,500 sq. yds. asphalt paving on concrete foundation. G. T. Bouton, Clk. St. Comrs.

ASHLAND, PA.—The following bids have been received for paving Claremont Ave. and Center St. with Canton brick:

	Labor.	Brick.	Total.
Eaton & Frey	$6,344	$10,215	$16,559
Herring & Straub	5,872	10,799	16,670
Gandert Bros	6,274	11,945	17,219
Raymond & Baker	6,845	10,510	17,352
O'Brien & Trapp	7,327	10,215	17,542
Wiest & Westover	8,148	11,091	19,238
Palmer & Betson	8,439	11,018	19,457
John Hadley	8,835	10,653	19,488
T. G. Stence	8,398	11,383	19,781
Louis Mayer	12,093	9,340	21,432

BALTIMORE, MD.—Bids are asked until Aug. 29 for curbing and paving Patterson Park Ave., and constructing gutters in Pratt St. A. E. Smyrk, Cy. Comr.

WASHINGTON, D. C.—Bids are asked by the commissioners until Sept. 4 for paving with asphalt and asphalt blocks.

JACKSONVILLE, FLA.—Bids are asked until Sept. 6 for furnishing 75,000 sq. yds. of paving brick. L. H. Mattair, Cy. Engr.

CARTHAGE, O.—Bids are asked until Sept. 10 for the purchase of $5,000 of bonds for constructing stone sidewalks. L. Hall, Village Clk.

LIMA, O.—The council has passed ordinances for constructing sidewalks in nine streets. C. E. Lynch, Cy. Clk.

OAK HARBOR, O.—Bids are asked until Sept. 1 for 4,100 sq. yds. of brick paving on a crushed stone foundation; estimated cost, $5,720. E. A. Smith, Cy. Engr.

SANDUSKY, O.—The following bids have been received for paving Columbus Ave. with Hallwood blocks: G. J. Doerzbach, $77,071; Coleman & Hallwood, $71,337; Jacobs & Stewart, $62,921; G. W. Doerzbach, $70,171; John McKean, $67,066; McKean & Callen, $66,919; Charles Schneider, $59,212; Hubbard & Talbot, $65,312; James Conley, $63,000.

SPRINGFIELD, O.—Bids are asked until Sept. 10 for constructing brick and cement sidewalks, curbing and crosswalks. S. J. Wilkerson, Cy. Clk.

DETROIT, MICH.—The council has received the following bids for repaving Washington Ave. with brick on concrete: Geo. E. Currie, $11,458; Sheehan & Co., $10,993; Lennane Bros., $10,511; Smith & Reynolds, $11,315; P. Dee, $11,093; Talbot Paving Co., $11,181; John McLoughlin, $11,703; Liphardt & Winterhalter, $11,177; Laidlaw Bros., $10,848. The following bids were received for repaving the same avenue with asphalt: Western Bermudez Co., $14,543; John McLoughlin, $15,523; Trinidad Asphalt Paving Co., $11,433; Warren-Scharf Asphalt Paving Co., $17,237.

LANSING, MICH.—The following bids have been received for paving Washington Ave.; G. A. Christ, Grand Rapids, $17,752; Woodcock & Kneal, $17,499; M. E. Fitzpatrick, $16,959.

ST. PAUL, MINN.—The council has voted to advertise for bids for paving portions of Fourth St., Seventh St. and Hennepin Ave. with asphalt.

BELLEVILLE, ILL.—Bids are asked until Aug. 25 for 544 ft. of brick paving. The work was advertised in our issue of July 26, but the bids were rejected. F. W. Puderer, Cy. Clk.

JOLIET, ILL.—Bids are asked until Aug. 27 for paving with brick Ottawa St., from Van Buren to Cass Sts.——At a meeting Aug. 6, the council appropriated $58,000 for permanent improvements. Cy. Engr., O. R. Ranchfuss; Cy. Clk., S. C. Rickson.

WACO, TEX.—The committee has recommended that the bids for paving South Fourth St. be rejected and the work will be readvertised. Stephen Turner, Cy. Engr.

CORNWALL, ONT.—Bids are asked until Aug. 27, inclusive, for 20,500 sq. ft. of granolithic walk. Geo S. Jarvis, Town Clk.

ELECTRIC LIGHT AND POWER.

ERIE, PA.—The council has passed an ordinance providing for an issue of $25,000 in bonds for a municipal electric light plant.

MECHANICSBURG, PA.—The council has directed that bids be asked for 40 lamps of 1,200 c. p., or 25 lamps of 1,500 c. p. for electric street lighting.

JACKSONVILLE, FLA.—Bids are asked until Sept. 6 for a municipal electric light plant, including 250 arc lights of 2,000 c. p., 300 incandescent lights of 32 c. p., 4,000 incandescent lights of 16 c. p. and 21 miles of wire. W. C. West, Recdr.

HAMMOND, LA.—Shafer & Griffin have been granted a 35-year franchise for electric street lighting.

KALAMAZOO, MICH.—The contract for building the municipal electric light plant, bids for which were given in our issue of Aug. 9, has been awarded to the Commercial Electric Engineering Co., Detroit. Chauncey Strong, Cy. Clk., informs us that all parties wishing information regarding any part of the work should address the above-named company.

O'FALLON, ILL.—A 20-year franchise has been granted to the O'Fallon Electric Light, Power, Heat & Water-Works Co., for an electric light plant. Philip Heyde and S. C. Smiley are interested.

IOWA FALLS, IA.—A 20-year franchise for an electric light plant has been granted to a Peoria firm.

OMAHA, NEB.—The city comptroller has been directed to advertise for bids for electric street lighting for three years.

KELSO, WASH.—An offer has been made to furnish the city with an electric light plant, to be operated by water power.

MONTEREY, CAL.—The Monterey Power Co. is investigating the feasibility of supplying power and electricity to Monterey and Pacific Grove from Little River.

NEW COMPANIES.—Lenox Electrical Co., Springfield, Mass.; $20,000; Pres., W. D. Curtis; Treas., I. J. Newman; Secy., W. G. Clifford.——Newport Light, Heat & Power Co., Newport, Pa.; $1,000; Treas., J. I. Leiby.——Jacksonville Electric Light & Power Co., Jacksonville, Ill.; $100,000; G. D. Stafford, S. H. Trude, W. H. Lee.——Citizen's Electric Light & Power Co., Pensacola, Fla.; $20,000.——Acme Electric Co., St. Louis, Mo.; $3,000; E. D. Goodlarlet, L. E. Goodlarlet.——Mercantile Carbon Co., New York, N. Y.; manufacturing a new electrode for arc lamps; $50,000; A. C. Seibold, H. Hoyt, S. M. Comstock.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

BONDS.—Canton, O.—Bids are asked by the ways and means committee until Sept. 12 for the purchase of $13,000 in bonds.

CITY HALL.—Peoria, Ill.—A press report states that W. H. Miller has been awarded the contract for the new city hall, at $115,000.

EARTH.—Portland, Me.—Bids are asked until Aug. 25 for delivering earth at Portland Head, Me. Lieut.-Col. Peter C. Hains, U. S. Engr. Office.

NAVAL SUPPLIES.—Washington, D. C.—Bids are asked until Aug. 28 for supplies for the New York navy yard. A. K. Michler, Acting Ch. of Bureau.

BUILDINGS, ETC.—Burlington, Vt.—Bids are asked until Sept. 13 for the construction of buildings, etc., at Fort Ethan Allen. Capt. Guy Howard, A. Q. M., U. S. A.

ARMORY BUILDING.—Albany, N. Y.—Bids are asked until Sept. 5 for the erection of an armory building at Niagara Falls. Arch., I. G. Perry. Address Josiah Porter, Adjutant-General.

GARBAGE CREMATORY.—New York, N. Y.—Bids are asked until Sept. 15 for the erection of a garbage crematory. Address the post quartermaster, Fort Wadsworth, New York Harbor.

IRON AND COPPER WORK.—Washington, D. C.—Bids are asked until Sept. 7 for iron stairs, interior iron and copper work, etc., for the U. S. public building at Newark, N. J. Jeremiah O'Rourke, Supervising Arch., Treasury Dept.

DREDGING.—Washington, D. C.—Bids are asked until Aug. 29 for dredging at Port Royal, S. C. Only one bid was received for this work at the recent opening and this was rejected. E. O. Matthews, Ch. of Bureau of Yards and Docks.

CONDUITS, ETC.—Washington, D. C.—Bids are asked until Sept. 6 for putting in place complete all the plumbing, gas piping and electric wire conduits for the U. S. public building at Charleston, S. C. Jeremiah O'Rourke, Supervising Arch., Treasury Dept.

DRAINAGE.—Marine City, Mich.—Bids are asked until Sept. 4 for constructing the south branch of Mill Creek drain in Lapeer and St. Clair counties. The work includes 414 stations and will be let as one section. Harrison H. Butler, Drain Comr. St. Clair Co.

GAS PIPE.—Glenville, O.—The Cleveland Gas Light & Coke Co. is reported as about to extend its service to this place. About 1½ miles of pipe will be required and the work is estimated to cost $12,000. The company is said to have 233 miles of gas mains now in use, exclusive of service pipes.

DRY DOCK WORK.—Seattle, Ore.—The "Post-Intelligencer" states that Byron Barlow & Co., contractors for the Port Orchard dry dock, have been awarded a supplemental contract by the government for about $80,000, and that 300 men will be put at work at once. The entire contract amounts to over $600,000.

GARBAGE DISPOSAL.—Boston, Mass.—The New England Construction Co., 92 State St., Boston, has been awarded a contract for the disposal of part of the garbage of the city. The garbage will not be cremated, but will be treated by a utilization process which extracts the grease and other valuable constituents present in the garbage.

LEVEE WORK.—Memphis, Tenn.—Capt. H. H. Rogers, of the St. Francis levee board, is reported to have stated that contracts will be let this month for 1,000,000 cu. yds. of work, and that the remaining 28 miles on the Arkansas side will be completed this fall. This will close up the entire basin from overflow up as far as the Missouri line.

DITCHES, ETC.—St. Paul, Minn.—Bids are asked until Sept. 1 for cutting ditches in Polk and Marshall counties; for improving the Snake River at Ada, in Norman county; for improving the Wild Rice River, and in the counties of Norman and Clay for improving the south branch of the Wild Rice River. Ezra G. Valentine, Pres. Red River Valley Drainage Comn.

WATER POWER.—Bangor, Pa.—Press reports state that capitalists in this vicinity are considering a project to lead the water from the Delaware River at the Delaware Water to Foul Rift, there to erect a power station with a capacity of 1,000 HP. and to convey it to this place by means of a canal or pipes, to be utilized to supply the motive power for the slate quarries and other industries in this section.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Aug. 24.	Fireproof building,	Fairfax, Va.	July 26
	Advertised, Eng. News, July 26 to Aug. 16.		
Aug. 24.	Disinfecting plant,	Washington, D. C.	Aug. 2
Aug. 24.	Grading (12 miles),	Wapakoneta, O.	Aug. 2
Aug. 24.	Granite and cobistn pvg,	Brooklyn, N. Y.	Aug. 16
Aug. 24.	Laying water pipe,	New York, N. Y.	Aug. 16
	Advertised, Eng. News, Aug. 16 and 23.		
Aug. 24.	Water-works system,	Forreston, Ill.	Aug. 16
Aug. 24.	Enlarging Island,	New York, N. Y.	Aug. 16
	Advertised, Eng. News, Aug. 16 and 23.		
Aug. 24.	Tunnel sewer,	Niagara Falls, N. Y.	Aug. 16
	Advertised, Eng. News, Aug. 16.		
Aug. 24.	Brick sewer,	Niagara Falls, N. Y.	Aug. 16
	Advertised, Eng. News, Aug. 16.		
Aug. 25.	Dredging,	Wilmington, N. C.	Aug. 2
	Advertised, Eng. News, Aug. 2 to 23.		
Aug. 25.	Sewers,	Marietta, O.	Aug. 2
Aug. 25.	Fireboat,	Boston, Mass.	Aug. 9
Aug. 25.	Sewers,	Zanesville, O.	Aug. 9
Aug. 25.	Well, etc.,	Austin, Ill.	Aug. 9
	Advertised, Eng. News, Aug. 9 to 23.		
Aug. 25.	Bridge,	Troy, O.	Aug. 16
Aug. 25.	Reservoir,	Kittanning, Pa.	Aug. 16
	Advertised, Eng. News, Aug. 9 and 16.		
Aug. 25.	Water-wks system,	Lancaster, Pa.	Aug. 16
Aug. 25.	Earth,	Portland, Me.	Aug. 23
Aug. 25.	Macadamizing, etc.,	Providence, R. I.	Aug. 23
Aug. 25.	Brick paving,	Belleville, Ill.	Aug. 23
Aug. 25.	Water bonds ($10,000),	Fulda, Minn.	Aug. 23
Aug. 27.	Canal, etc. (5 miles),	Chicago, Ill.	Aug. 2
	Advertised, Eng. News, Aug. 2 to 23.		
Aug. 27.	Bonds ($5,000),	Lamberton, Minn.	Aug. 9
Aug. 27.	Sidewalk improvemts,	Louisville, Ky.	Aug. 16
Aug. 27.	Brick sidewalks,	Muncie, Ind.	Aug. 16
Aug. 27.	Court room and jail,	Ottawa, Ont.	Aug. 14
Aug. 27.	Grading and curbing,	South Bend, Ind.	Aug. 16
Aug. 27.	Pipe sewers (11 miles),	Bloomfield, N. J.	Aug. 23
	Advertised, Eng. News, Aug. 23.		
Aug. 27.	Asphalt paving,	Jersey City, N. J.	Aug. 23
Aug. 27.	Crushed stone,	Newark, N. J.	Aug. 23
Aug. 27.	Steel bridges,	Joliet, Ill.	Aug. 23
Aug. 27.	Brick paving,	Joliet, Ill.	Aug. 23
Aug. 27.	Pipe sewers (3,886 ft.),	Fort Dodge, Ia.	Aug. 23
Aug. 27.	Granolithic walk,	Cornwall, Ont.	Aug. 23
Aug. 28.	Removing wreck,	Boston, Mass.	Aug. 2
Aug. 28.	Water-wks system,	Cedar Rapids, Neb.	Aug. 9
Aug. 28.	Disinfecting plant,	San Diego, Cal.	Aug. 9
Aug. 28.	Water-works system,	Alton, Ia.	Aug. 16
Aug. 28.	Brick paving,	Troy, N. Y.	Aug. 23
Aug. 28.	Naval supplies,	Washington, D. C.	Aug. 23
Aug. 28.	Service w. pipes (11 streets),	Chicago.	Aug. 23
Aug. 28.	Sewers (45 contracts),	Chicago, Ill.	Aug. 23
Aug. 28.	Brick sew'rs (8,300 ft.),	St. Louis, Mo.	Aug. 23
Aug. 28.	Pipe sewers (11,470 ft.),	St. Louis, Mo.	Aug. 23
Aug. 29.	Water-wks. system,	Richmondville, N. Y.	Aug. 16
	Advertised, Eng. News, Aug. 16 and 23.		
Aug. 29.	Cobblestone paving,	Brooklyn, N. Y.	Aug. 23
Aug. 29.	Dredging,	Washington, D. C.	Aug. 23
Aug. 29.	Paving,	Baltimore, Md.	Aug. 23
Aug. 29.	Bridge bonds,	Cincinnati, O.	Aug. 23
Aug. 30.	Paving (8,800 sq. yds.),	Dunkirk, N. Y.	Aug. 16
	Advertised, Eng. News, Aug. 16 and 23.		
Aug. 30.	Grading,	Washington, D. C.	Aug. 16
	Advertised, Eng. News, Aug. 16 and 23.		
Aug. 30.	Pipe sewers,	Charlottesville, Va.	Aug. 16
	Advertised, Eng. News, Aug. 16 to 30.		
Aug. 30.	Dredging,	New York, N. Y.	Aug. 16
Aug. 30.	Buildings,	Franklin, Pa.	Aug. 16
Aug. 30.	Wooden piers,	New York, N. Y.	Aug. 16
Aug. 30.	Bridge plans,	Sacramento, Cal.	Aug. 23
Aug. 30.	Sewer,	Dayton, O.	Aug. 23
Aug. 31.	Reservoir,	Cambridge, Mass.	Aug. 2
	Advertised, Eng. News, Aug. 2 and 9.		
Aug. 31.	Dredge,	Ottawa, Ont.	Aug. 16
Sept. 1.	Pipe, pump, etc.,	Honolulu, H. I.	July 19
	Advertised Eng. News, July 19 to Aug. 2.		
Sept. 1.	Electric lighting,	Portland, Ore.	June 21
Sept. 1.	Electric lighting,	Toronto, Ont.	Aug. 2
	Advertised, Eng. News, Aug. 2 to 16.		
Sept. 1.	Electric light plant,	Toronto, Ont.	Aug. 2
	Advertised, Eng. News, Aug. 2 to 16.		
Sept. 1.	Pump'g engs., etc.,	Providence, R. I.	Aug. 9
	Advertised, Eng. News, Aug. 9 to 30.		
Sept. 1.	Water bonds ($10,000),	Rushford, Minn.	Aug. 9
Sept. 1.	Electric subw'y cond't,	Baltimore, Md.	Aug. 16
Sept. 1.	Street improvements,	Mansfield, O.	Aug. 16
Sept. 1.	Brick paving,	Oak Harbor, O.	Aug. 23
Sept. 1.	Water pipe ext'n,	Tomahawk, Wis.	Aug. 23
Sept. 1.	Ditches, etc.,	St. Paul, Minn.	Aug. 23
Sept. 1.	Water bonds ($20,000),	Wells, Minn.	Aug. 23
Sept. 3.	Bridge,	Dillon, Mont.	July 5

Sept. 3.Brick sewers, Montgomery, Ala.....Aug. 16
Sept. 3.Pipe sewers, Montgomery, Ala.....Aug. 16
Sept. 3.Sewer bonds, ($76,000), Covington, Ky.Aug. 16
Sept. 3.Street improvements, Muncie, Ind.....Aug. 16
Sept. 3.Water-works system, Traer, Ia.....Aug. 23
Sept. 3.Bridge, Concord, N. H.....Aug. 23
Advertised, Eng. News, Aug. 23
Sept. 3.Wooden bridges, Yankton, S. Dak....Aug. 23
Sept. 4.Asphalt or brick paving, Dayton, O....Aug. 16
Sept. 4.Pumping plant, etc., Dekalb, Ill.....Aug. 16
Advertised, Eng. News, Aug. 16 to 23.
Sept. 4.Canal work, Ottawa, Ont.....Aug. 16
Sept. 4.Asp. and asp. blk pvg, Washington,D.C.Aug. 23
Sept. 4.Irrigation work, Winchester, Cal.....Aug. 23
Sept. 4.Pipe sewers, Bound Brook, N. J.....Aug. 23
Advertised, Eng. News, Aug. 23 and 30.
Sept. 4.Drainage, Marine City, Mich.....Aug. 23
Sept. 4.Flagging (23 contracts), Brooklyn, N.Y.Aug. 23

Sept. 5.Operating machinery, Detroit, Mich...Aug. 9
Advertised, Eng. News, Aug. 9 to 30.
Sept. 5.Armory building, Albany, N. Y.....Aug. 23
Sept. 5.Water-works system, Quincy, Mich..Aug. 23
Advertised, Eng. News, Aug. 23 and 30.
Sept. 5.Pipe sewers (27,455 ft.), Plainfield,N.J.Aug. 23
Advertised, Eng. News, Aug. 23 and 30.
Sept. 6.Lock houses, Louisville, Ky.....Aug. 9
Sept. 6.Asphalt paving, Cincinnati, O.....Aug. 16
Sept. 6.Water-works system, Hamilton, N. Y...Aug. 23
Advertised, Eng. News, Aug. 23 and 30.
Sept. 6.Conduits, etc., Washington, D. C.....Aug. 23
Sept. 6.Paving brick, Jacksonville, Fla.....Aug. 23
Sept. 6.Water-works system, Syracuse, Neb....Aug. 23
Sept. 6.Water bonds ($10,500), Syracuse, Neb..Aug. 23
Sept. 6.Electric light plant, Jacksonville, Fla..Aug. 23
Sept. 7.Bonds ($14,362), Norwood, O.....Aug. 16
Sept. 7.Intake pier, Tonawanda, N. Y.....Aug. 23
Advertised, Eng. News, Aug. 23 and 30.
Sept. 7.Iron and copper w'k, Washington,D.C.Aug. 23
Sept. 7.Stone paving, New York, N. Y.....Aug. 23
Sept. 8.Asphalt paving, Cincinnati, O.....Aug. 16
Sept. 10.City hall and market, Jacksonville, Fla.Aug. 16
Sept. 10.Bridge, Toledo, O.....Aug. 16
Sept. 10.Bridges, Helena, Mont.....Aug. 16
Sept. 10.Sidewalk bonds ($5,000), Carthage, O..Aug. 23
Sept. 10.Brick sidewalks, Springfield, O.....Aug. 23

Sept. 11.Light station, New Orleans, La.....Aug. 16
Sept. 11.Metal work, New Orleans, La.....Aug. 16
Advertised, Eng. News, Aug. 16 to Sept. 6.
Sept. 12.Brick paving, Cleveland, O.....Aug.16
Sept. 12.Bonds ($13,000), Canton, O.....Aug. 23
Sept. 13.Buildings, etc., Burlington, Vt.....Aug. 23
Sept. 14.Electric light plant, Lancaster, Pa....Aug. 16
Sept. 15.Water bonds ($100,000), Detroit, Mich.Aug. 16
Sept. 15.Garbage crematory, Ft.Wadsworth,N.Y.Aug. 23
Sept. 17.Iron hoist bridge, Dayton, O.....Aug. 23
Sept. 18.Water-works system, Guttenberg, Ia..Aug. 23
Advertised, Eng. News, Aug. 23 to Sept. 6.
Sept. 29.Bridges, Indianapolis, Ind.....Aug. 23
Oct. 2.Water-w'ks franchise, Greenville, Miss.Aug. 23
Advertised, Eng. News, Aug. 23 to Sept. 13.

METAL MARKET PRICES.

LEAD.—New York: 3.55 to 3.6 cts. Chicago: 3.35 cts. St. Louis: 3.2 to 3.24 cts.

TRACK MATERIAL.—New York: angle bars, 1.25 to 1.4 cts.; spikes, 1.5 to 1.7 cts.; track bolts, 2 to 2.1 cts. with square and 2.1 to 2.3 cts. with hexagon nuts. Chicago: angle bars, 1.25 to 1.35 cts.; spikes, 1.75 to 1.8 cts.; track bolts, 2.1 to 2.15 cts., with hexagon nuts.

RAILS.—New York: $24 to $25 at eastern mills and at tide water; old rails, $11 to $11.50 for iron, and $10 for steel; steel rails fit for relaying, $16 to $16.50; light rails, $22 to $24; girder rails, $24. Pittsburg: $24 for standard sections. Chicago: $25 to $27; old rails, $11 for iron and $8 to $10 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.4 to 1.5 cts.; channels, 1.4 to 1.5 cts.; angles, 1.3 to 1.35 cts.; tees, 1.5 to 1.6 cts.; universal mill plates, 1.25 to 1.35 cts.; steel plates, 1.25 to 1.4 cts. for tank, 1.4 to 1.5 cts. for shell, 1.6 to 1.65 cts. for flange, 1.75 to 2 cts. for ordinary firebox, 2 to 2.25 cts. for locomotive firebox. Pittsburg: beams, 1.3 to 1.4 cts.; channels, 1.3 to 1.4 cts.; angles, 1.25 to 1.35 cts.; 1.4 to 1.5 cts.; universal mill plates, 1.25 to 1.35 cts.; steel plates, 1.2 to 1.3 cts. for tank, 1.35 to 1.4 cts. for shell, 1.45 to 1.5 cts. for flange, 2.5 to 3 cts. for ordinary firebox, and 3.35 to 3.5 cts. for locomotive firebox. Chicago: beams, 1.5 cts.; channels, 1.5 cts.; angles, 1.45 cts.; tees, 1.65 cts.; universal plates, 1.45 cts.; steel plates, 1.45 to 1.55 cts. for tank, 1.5 to 1.6 cts. for shell, 1.65 to 2.1 cts. for flange, 1.65 to 5 cts. for firebox.

CONTRACT PRICES.

SEWER PIPE, CEMENT AND BRICK.—Medford, Mass.—The following bids were received Aug. 9: Sewer pipe.—Waldo Bros., Boston. Akron pipe, 72½% discount on deep socket; Keystone pipe, 76% on deep socket, and 77½% on standard socket; Portland Stoneware Co., Boston, Portland pipe, 74½% and 77½% respectively; Lock Haven (Pa.) Pipe Co., 75% on both; W. G. Nash, Boston, Ohio River pipe, 76% and 78%. Cement.—Waldo Bros., Rock Lock and Hoffman, Rosendale, $1.03½ and $1.09½ per bbl., respectively, and J. L. Spoor, Brooks Shoobridge & Co., and Alsen, Portland, $2.08, $2.20 and $2.60; Berry & Ferguson, A. J. Snyder & Son, Rosendale, $1.03½, and Victoria, Portland, $2.07½; W. G. Nash, Hudson River, Rosendale, $1.04 in carload or $1 in 500 bbl. lots, and Dunmore and Offenbacher, Portland, $2 and $2.10. Brick.—Bay State Brick Co., Boston, Medford brick, on line of sewer, $8.50; Parry Bros., Boston, New Hampshire brick, on cars, $7.50, or Cambridge brick, on line of sewer, $8.

STONE PAVING.—Albany, N. Y.—Thomas J. Lanahan, Clk Board of Contract, writes us that the contract for paving Daniel St. with granite blocks has been awarded to P. H. Reilly, at $4,046, the bidders being the same as for the paving of Beaver St. The bids for paving Beaver St. with granite blocks were as follows:

Bids Received Aug. 6, 1894, for Paving Beaver St., Albany, N. Y., with Granite.

Bidder.	Granite per sq.yd.	Curb—strght, lin.ft.	Curb—circlr, lin.ft.	Cross-walks sq.ft.	Repaving sq.yd.	Relaying curb, lin.ft.	Brick walk, lin.ft.	Brick walk, sq.yd.	Flag walk, sq.yd.	Remov-ing tree.	Credit cobble, sq.yd.	Total.
R. H. Strong, Albany, N. Y.	$3.14	$1.14	$1.53	$0.39	$0.45	$0.18	$0.20	$0.09	$0.15	$15.00	$0.04	$4,345
P. Callanan, S.Bethlehem,N.Y.	3.24	1.09	1.14	.24	.29	.20	.10	.05	.14	1.00	.02	4,307
Jas. J. Cuddy, Albany, N. Y...	3.80	1.05	1.05	.40	1.00	.25	.50	.05	.12	10.00	.01	5,049
Pidgeon & Co., " " " " ..	3.19	1.25	1.25	.40	.65	.55	.50	.15	.20	5.00	.01	4,585
W. J. McCann, " " " " ..	4.30	1.28	1.45	.54	.75	.20	.28	.10	.28	45.00	.05	5,819
Geo. Hollis, Jr., " " " " ..	3.31	1.12	1.12	.30	.40	.07	.15	.05	.14	5.00	.02	4,434
P. H. Reilly, " " " " ..	3.20	1.00	1.20	.30	.30	.30	.50	.06	.13½	5.00	.01	4,345

DITCH EXCAVATION.—Racine, Wis.—Press reports state that bids have been received for excavating a ditch five miles in length that will drain 900 acres of land along Skunk Creek, between Western Union Junction and Franksville. The work will require about 29,000 cu. yds. of excavations, and the lowest bid was 12½ cts. per cu. yd.

Bids Received for Constructing Sewers at Athol, Mass.

	8-in.	10-in.	12-in.	18-in.	Flush tanks.	Man-holes.	Lamp-holes.	Siphons.	Rock work.	Total.
A. W. Bryne, West Medford, Mass.	$0.45	$0.45	$0.70	$1.00	$75.00	$30.00	$4.00	$300.00	$6.00	$39,499
D. O'Connell & Son, Holyoke,Mass.	.46	.57	.63	1.00	60.00	30.00	2.20	40.00	2.25	35,645
Connors & Co., Lowell, Mass.....	.83	.89	.96	1.18	64.00	32.90	3.48	15.00	3.25	57,337
Bishop & Taylor, Athol, Mass.....	.70	1.10	1.40	1.75	90.00	40.00	5.00	150.00	4.00	57,001
Albert A. Sibley, Boston, Mass.....	.48	.90	.87	1.25	75.00	40.00	1.50	75.00	6.00	45,019
Brosnan & Sica, Northampton,Mass	.55	.68	.95	1.50	70.00	40.00	1.50	72.00	4.50	44,830
Gennaro,Long & Little, S.Braintree.	.39	.47	.60	.80	75.00	35.00	2.25	300.00	4.00	34,010
G. M. Atkins & Co., Palmer, Mass.	.70	.80	.90	1.10	90.00	45.00	3.00	100.00	5.00	53,945

ELECTRIC LIGHT PLANT.—St. Bernard, O.—The contract for constructing the electric light plant has been awarded to the Fort Wayne Electric Corporation; Consult. Engr., Geo. Hornung, Cincinnati. The bids received were as follows:

Bids Received July 7, 1894, for an Electric Light Plant, S. Bernard, O.

Bidder.	Alternating incandescent and constant current arc system.	68 arc lamps.	Converters for 500 16-c. p. lamps.	500 16-c. p. lamps.	500 key sockets.	Total.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa	$9,862.00	$1,190.00	$426.00	$193.75	Incl'd'd	$11,671.75
" " " " " "	9,662.00	1,190.00	426.00	193.75	"	11,471.75
Commercial Electric Eng. Co., Detroit, Mich.	9,255.50	1,530.00	500.00	140.00	$70.00	11,495.50
General Electric Co., Cincinnati, O.	9,652.85	[1]1,306.50	549.00	125.00	75.00	11,708.35
Devere Electric Co., Cincinnati, O.	9,450.00	1,525.00	520.00	145.00	75.00	11,715.00
Fort Wayne Electric Corporation, Fort Wayne, Ind.	8,817.00	1,574.20	450.00	150.00	90.00	[2]11,081.20

[1] Add $302 for double carbon lamps. [2] Deduct $214.20 if hoods are not used.

PIPELAYING.—Syracuse, N. Y.—The lowest bid received by the water board Aug. 10 for trenching and pipelaying was noted last week. W. R. Hill, Ch. Engr., informs us that the bids were as follows, the contract being awarded to the lowest bidder:

Bids Received by Syracuse (N. Y.) Water Board Aug. 10, 1894, for Trenching and Pipelaying.

Items.	Fales & O'Donnell, N. Tonawanda.	Marnell & Healy, Syracuse.	Kinney & Dwyer, Syracuse.	O'Connor & Co. Syracuse.	C. Beckwith, Herkimer.	G. D. Grannis, Syracuse.	Lindsay & Van Loon, Plymouth, Pa.	Dawson & Barker, Syracuse	MatthewDillon, Syracuse.
Hauling and distribut'g pipes,1,000 tons	$0.85	$0.65	$0.67	$0.60	$0.60	$0.75	$0.70	$0.75	$0.80
[1]Trenching and refilling, 36,700 lin ft.	.16	.16	.155	.175	.18	.205	.20	.23	.28
[2]Trenching and refilling, 4,600 lin ft....	.21	.26	.33	.27	.28	.25	.30	.33	.35
Tr'ch'g and f'rn'g 1-in. l'd p.,850 lin.ft.	.20	.34	.40	.35	.35	.46	.35	.40	.60
1-in. lead p. frnshd and laid,2,550 lin.ft.	.16	.18	.21	.16	.25	.17	.28	.21	.25
Laying joining and calking:									
4-in. pipe, 600 lin. ft.....	.06	.05	.08	.05	.06	.06	.07	.08	.06
6-in. " 13,000 " "	.06	.10	.08	.09	.10	.085	.09	.10	.07
8-in. " 17,800 " "	.10	.11	.12	.11	.12	.105	.12	.11	.10
10-in. " 5,300 " "	.12	.13	.15	.15	.14	.15	.15	.14	.13
12-in. " 300 " "	.15	.15	.20	.18	.16	.18	.19	.25	.20
16-in. " 3,600 " "	.21	.21	.23	.25	.20	.26	.30	.26	.22
20-in. " 700 " "	.28	.27	.35	.33	.28	.35	.35	.37	.30
Unjointing, removing, etc., old cast iron pipe, 12-in., 1,000 lin. ft.....	.10	.06	.05	.07	.05	.10	.07	.08	.09
Loose stone in place, 50 cu. yds.....	2.00	1.75	2.00	1.75	1.60	1.50	1.90	1.75	1.65
Rubble masonry in cement, 30 cu. yds.	4.00	4.00	5.00	4.50	4.50	4.50	4.00	5.00	3.70
Brick masonry in cement, 30 cu. yds...	9.00	8.00	10.00	8.50	9.00	9.00	9.50	9.00	9.00
Excavating and refilling test pits, 20..	1.00	1.00	1.00	1.00	.75	.90	1.00	1.50	1.15
Extra lead joints for 6-in. cut pipe, 15..	.50	.65	.75	.60	.67	.60	.60	.80	.70
" " " " 8-in. " " 40..	.75	.70	.95	.70	.94	.80	.85	1.00	.90
" " " " 10-in. " " 20..	.85	.80	1.15	.80	1.04	1.00	1.00	1.20	1.20
" " " " 12-in. " " 5..	1.00	1.35	1.45	1.10	1.34	1.20	1.25	1.60	1.50
" " " " 16-in. " " 5..	1.50	1.75	2.35	1.60	1.80	1.50	1.50	2.25	2.20
" " " " 20-in. " " 2..	2.00	2.25	2.75	2.00	2.10	1.90	2.00	3.50	3.00
Total.....	$13,176	$14,034	$14,621	$14,746	$15,245	$15,964	$16,627	$17,622	$18,982

[1] 4, 6, 8 and 10-in. pipes. [2] 12, 16 and 20-in pipes.

STAND-PIPE.—Oak Cliff, Tex.—J. S. Thatcher,Engr., Dallas, writes us that the following bids have been received for a 14 × 80-ft. stand-pipe:

Elmore Iron Wks., Birmingham, Ala.....	$2,230
Geo. E. King Bridge Co., Des Moines, Ia....	2,298
Corbett & Stadler, Aurora, Ill.....	2,305
Harvey Boiler Wks., Harvey, Ill.....	2,350
Riter & Conley, Pittsburg, Pa.....	2,420
Stacy Mfg. Co., Cincinnati, O.....	2,500
The L. Schreiber & Sons Co., Cincinnati, O...	2,658
Springfield Boiler Wks., Springfield, O.....	3,000
South Western Bridge & Iron Co., Ft. Worth	3,050

SEWERS.—Fostoria, O.—R. W. Lysle, Cy. Engr., writes us that the following bids were received Aug. 10 for constructing sewers in two districts:

	No. 2.	No. 4.
W. M. Skinner, Fostoria, O.....	$6,648	.....
M. Hughes, Fremont, O.....	6,128	.....
Bulger & Howell, Fostoria, O.....	6,185	.....
T. L. Brannan, Fostoria, O.....	4,864	$8,743[1]
W. W. Cook & Co., Jamestown, N. Y..	5,889	11,036[2]
J. J. Runsey & Co., Fostoria, O.....	*	10,521[3]
L. Schouder, Tiffin, O.....	5,887	11,300[4]
G. D. & W. S. Hersey, Youngstown, O.	5,268	9,322[5]
J. J. Peter & Co., Fostoria, O.....	....	8,000[6]

* Total not given.

The prices of the bids for the sewer in district No. 4 were as follows:

	1.	2.	3.	4.	5.	6.
Earth excav.,per cu.yd.	$.25	$.38	$.33½	$.40	$.33½	$.38½
Gravel refill, " " "	.60	1.00	.60	.75	1.25	1.00
Rock excav., " " "	3.00	...	1.70	2.50	1.75	2.50
Brick mas., " " "	2.04	2.50	2.80	2.70	2.20	1.86
Concrete mas., " " "	4.00	2.00	3.00	3.50	3.00	1.90
Pipelaying, per lin. ft.	.05	.08	.06½	.06	.03½	.0
Vert. h'se c'ns, " "	.01	.10	.25	.05	.10	.06
L'g subdrains, " "	.02	.08	.01	.03	.02	.01
Lead pipe, per lin. ft.	.50	.60	.25	.50	.35	.45
Macadam, " " "	.75	.80	1.25	.50	1.00	.90
Embankment, " " "	.20	...	...	.25	.25	.35
Ashler mas., " " "	7.50	10.00	9.00	10.00	7.00	7.00
Ripraping, per sq. yd.	2.00	...	...	.50	.40	...

Athol, Mass.—E. V. Wilson, chairman Sewer Comrs., writes us that the following bids were received July 31 for constructing sewers, the quantities being 48,000 ft. of 8-in. pipe, 6,000 ft. of 10-in., 3,240 ft. of 12-in., 820 ft. of 18-in., 29 manholes, 36 flushtanks, 2 siphons, 230 ft. of iron outlet and about 1,200 cu. yds of rock work:

DREDGING.—Boston, Mass.—The following bids were received by the state board of health, Aug. 17, for dredging bars in the Concord and Sudbury rivers, about 40,000 cu. yds.:

	Per cu. yd.
Hugh Farrell and J. Scully, Somerville, Mass.	.97 cts.
Perkins & White, Boston, Mass.....	.53 "
Eastern Dredging Co., Boston, Mass.....	.48 "
Conners & Co., Lowell, Mass.....	.37.5 "
Thomas Symonds, Leominster, Mass.....	.33.5 "

BRICK PAVING.—Marion, O.—The contracts for paving Center and Main Sts. have been awarded to Coleman & Halwood, Columbus, at $1.59 and $1.61 per sq. yd., respectively for the two streets. The work is reported as to cost about $116,000.

Huntingdon, Pa.—The contract for paving Fourth St., from Penn St. to the bridge, has been awarded to Horace V. Johnston, Huntingdon, at $1.75 per sq. yd. for Koontz shale brick. Mr. Johnston bid $1.73 for Mill Hall brick and $2 for Canton brick.

PIPE, VALVES, ETC.—East Radford, Va.—Contracts for proposed extensions of the city water-works have been awarded as follows: Radford Pipe & Foundry Co., pipe, at $18 per ton; Ludlow Valve Mfg. Co., hydrants at $21.50, 8-in. valves at $17, and valve boxes at $2.13 each; D. A. Allen & Co., Radford, received the contract for pipelaying, etc.

PIPE.—Washington, D. C.—The following bids were received by the district commissioners Aug. 11 for cast iron water pipe, the quantities being 10,000 ft. of 4-in., 50,000 ft. of 6-in. and 5,000 ft. of 12-in. pipe; price is per ton of 2,240 lbs.:

	4-in.	6-in.	12-in.
[1]Radford Pipe & Foundry Co.	$20.48	$20.48	$20.48
McNeal Pipe & Fdry Co., Burlington	21.75	21.75	21.75
Anniston P. & Fdry Co., Anniston..	21.30	21.30	21.30
[2]F. B. Hawkins & Co., 29 B'way..	23.25	23.25	22.25
M. J. Drummond, 192 B'way, N.Y...	20.50	20.15	19.95

[1] Radford, Va. [2] New York.

Oak Cliff, Tex.—J. S. Thatcher, Engr., Dallas, writes us that the following bids were received for furnishing pipe for the proposed water-works: South Pittsburg, Tenn., pipe, $25.50 per ton and specials, 2½ cts. per lb.; Anniston, Ala., pipe, $25.50 and 2⅝ cts.; Howard-Harrison Iron Wks., Bessemer, Ala., $22.50 for 6-in., $24 for 4-in., and 2½ cts. for specials; Chattanooga, Tenn., pipe, $23 and 2¾ cts.; Rusk, Tex., pipe, $22.50 and 2¼ cts.

PIPE, VALVES, HYDRANTS, ETC.—Carey, O.—The bids received Aug. 1 for hydrants ranged from $19.46 to $24.25 each, according to bidder and pattern of hydrant. The bids for 49 valves were as follows; Engr., J. S. Humphrey, Findlay, O.:

	Check, 12-in.	Gate, 12-in.	10-in.	8-in.	6-in.	4-in.	Valve boxes
	$	$	$	$	$	$	$
J. B. Clow & Son..	....	34.20	24.22	18.05	11.63	7.20	2.75
"	.....	26.75	21.00	15.00	9.00	6.00	2.75
G. Worthington Co..	33.00	29.80	23.00	16.40	10.70	6.50	2.60
R. D. Wood & Co..	38.00	30.50	22.50	16.00	11.10	6.75	2.90
Bourbon C. & B. Co.	32.00	29.30	21.40	16.75	10.00	6.65	2.68
Ludlow Vlv.Mfg.Co.	36.70	29.60	23.38	16.33	10.90	6.58	3.00
Crane & Co.....	....	27.00	21.50	15.00	9.00	6.00	....

MACADAMIZING.—Boston, Mass.—H. H. Carter, Supt. of Sts., informs us that the following bids were received Aug. 7 for a telford macadam road in Parker street:

Bids Received for Macadamizing Parker St., Boston.

	H. P. Nawn.	Robt. Davis.	A. Doherty & O'Leary.	H. Gow & Co.	A. A. Libby & Co.
Subgrading, 500 cu. yds. at.....	$.35	$.28	$.37	$.25	$.75
Telford base, 5,870 sq. yds. at.....	.50	.64	.67	.65	.80
Macadam (stone furnished by city), 5,870 sq. yds. at.....	1.00	.60	.49	.60	.65
Granite block gutters, 1,420 sq. yds. at.....	2.10	2.20	2.06	2.35	2.45
Edgestone, 3,040 lin. ft. at.....	.80	.85	.87	.87	.87
Brick sidewalks, 3,210 sq. yds. at.....	1.00	1.02	.95	1.05	1.10
Flagging crosswalk, 282 sq. yds. at.....	.95	4.45	3.85	4.35	4.75
Gravel, 500 cu. yds. at.....	.75	1.00	1.10	1.24	1.50
Total.....	$18,119	$18,156	$17,249	$18,540	$20,631

PIPELAYING AND INSPECTION.—Albany, N. Y.—The following bids were received for laying 11,200 ft. of 30-in. water main: J. E. Pidgeon, Albany, $1.17 per ft. (awarded contract); J. Doyle, $1.19; M. J. Dady, $1.20; Clinton Beckwith, $1.37; J. Fitzgerald, $1.44; Oscar Hilt, $1.47; N. McDonald, $1.75. The contract for inspecting the pipe was awarded to the American Engineering & Inspecting Association, Albany, at 30 cts. per gross ton.

STAND-PIPE.—Carey, O.—J. S. Humphrey, Engr., Findlay, writes us that the following bids were received for furnishing a 16 × 115-ft. standpipe for the new water-works:

L. Schrieber & Sons Co.	$4,794
Chicago Bridge & Iron Co.	4,350
Brownell & Co.	3,750
Adams Bros.	4,480
Variety Iron Works.	4,850
Cousins Manufacturing Co.	3,920

WATER TOWER FOUNDATION.—St. Bernard, O.—The contract for the foundation for the water tower for the new water-works has been awarded to Michael Stopper. Geo. Hornung, Engr., informs us that the bids were as follows, all the bidders being residents of Cincinnati:

	Earth excav., 375 cu. yds.	Concrete footing, 120 cu. yds.	Rubble, lime and range sandstone masonry, 475 cu. yds.	Total
Boughen Eng'ring Co.	$0.75	$5.60	$9.90	$5,656
The A. Desch Co..	0.20	5.10	6.05	3,561
P. Murray & Sons....	0.25	4.00	8.75	4,730
Theodore Koenig	0.35	4.65	11.75	6,271
Michael Stopper	0.25	3.60	5.96	3,357

GRANITE AND ASPHALT BLOCK PAVING.—Newburg, N. Y.—The following bids have been received for paving, according to press reports, the bidders being (1) Hastings Paving Co., (2) Wm. F. Hogan, (3) Hawkes & Stratford, and (4) Orr Bros. (awarded contract):

	1.	2.	3.	4.
Asphalt blocks,* per sq. yd..	$3.10	.....	$3.50	$2.79
Granite blocks,** per sq. yd.	$2.40	2.34	2.79	
Granite blocks,*** per sq. yd.	3.90	3.36	3.29	
Bridge stone, per lin. ft.....	1.00	.65	.54	.55
Curbstone, per lin. ft.....	.60	.50	.41	.35
Relaying curb, per lin. ft.....	.....	.13	.10	.13

* On concrete foundation. ** Sand foundation.
*** Concrete foundation with tar and asphalt cement.

BRICK AND ASPHALT BLOCK PAVING.—Ironton, O.—J. R. C. Brown, Cy. Engr., informs us that the bids received Aug. 15 for 16,050 sq. yds. of paving with brick or asphalt blocks in Sixth St. ranged as follows:

	Brick.	Asphalt blocks.
E. W. Cox, Huntington, W. Va....	$1.51	$2.68
W. J. Berry, Parkersburg, W. Va..	$1.33 to $1.47	....
Dillon & Cook, Ironton, O.....	1.19½	2.30
Maloney, Jamison & Maloney*.....	1.14 to 1.15	2.24
C. L. Crowley, Hamilton, O.....	1.20 " 1.43	2.33
P. H. Kelley, Portsmouth, O.....	1.24½ to 1.46	....
Jas. I. Frampton.....	1.54	....
Gantz & Sullivan, Columbus.....	1.23 to 1.45	2.40
Martin Schreiber, Ironton.....	1.19¼ to 1.29½	2.26
T. J. Mulligan, Ironton.....	1.10 " 1.29	2.19
J. N. Anderson, Ironton.....	1.45 " 1.56	....
Huntington (W. Va.) Const'n Co...	1.32	2.41
A. T. Tubman, Gallipolis, O.....	1.21 " 1.27½	2.43
J. E. Riley, Omaha, Neb.....	1.18 " 1.25	2.90

*Bellaire.

ASPHALT PAVING.—Chicago, Ill.—The following bids were received Aug. 7 for paving La Salle Ave. with asphalt, press reports stating that the lowest bid was made on Trinidad Lake asphalt:

James A. W. Pine, New York, per sq. yd.....	$1.61
Western Paving Supply Co., per sq. yd.....	2.43
Trinidad Asphalt Co., per sq. yd.....	1.95
Bermudez Asphalt Co., per sq. yd.....	1.81
Barber Asphalt Co., per sq. yd.....	2.64

Troy, N. Y.—The contract for paving State St., from River to Seventh Sts., about 7,800 sq. yds., with asphalt, has been awarded to the Northern New York Asphalt Co., at $3.06 per sq. yd. for the paving, 75 cts. per sq. ft. for new bridge stone, 87 cts. per lin. ft. for new curb, 15 cts. for resetting old curb, $3.30 per sq. yd. for resetting granite blocks, 12 cts. per sq. ft. for resetting old bridge stone, and $45 for each catch basin. This was the only bid received. The price paid for the other asphalt pavements is reported as follows: Sixth Ave., $3.01; Seventh St., $3.33; Hutton and Rensselaer Sts., $3.07; North Fourth St., $3.10; Eighth St., $3.28.

Rochester, N. Y.—The contract for 3,880 sq. yds. of asphalt paving in North Goodman St. has been awarded to the Rock Asphalt Pavement Co., at $2.65 per sq. yd. The bids were as follows, (1) being the price for a 5-year guarantee and (2) the price for a 10-year guarantee:

	Per sq. yd. 1.	Per sq. yd. 2.	Total— 1.	Total— 2.
Rock Asphalt Pavement Co...	$2.60	$2.65	$7,138	$7,332
Warren-Scharf Asphalt P. Co.	2.40	2.50	7,083	7,451
Rochester Vul. Pavem't Co...	2.25	2.40	7,837	8,419

Schenectady, N. Y.—The contract for paving Summit Ave. with asphalt has been awarded to the Northern New York Asphalt Paving Co., the bids per sq. yd. for the paving being as follows; Cy. Engr., L. B. Sebring:

		Total.
Barber Asphalt Paving Co.....	$2.94	$9,207
Warren-Scharf Asphalt Paving Co....	2.97	9,237
Northern New York Asphalt Paving Co.	2.74	8,528

SEWERS.—Medford, Mass.—The total bids received Aug. 9 for constructing sewers were published Aug. 16 under Sewers. The itemized bids for building portions of sections 9 and 11 were as follows; Engr., T. Howard Barnes:

Bids for Constructing Portions of Sections 9 and 11, Medford, Mass., Sewerage System.

		A. W. Bryne, W. Medford.	John J. Dorey, Somerville.	Weaving & Booth Co., Medford.	P. F. Loney, Gen. Co., Boston.	Nat. Con. Co., Boston.	F. A. Snow, Boston.	D. O'Connell, Boston.	Falvey & Butterfield, Somerville.*	Gennaro, Long & Little.	Cummings & Collins.*	Lindsey & Cudmore.*	J. N. Drew Co., Malden.
Earth excavation,	0 to 8 ft., 8,000 cu. yds.	$.40	$.55	$.59	$.47⅝	$.57	$.65	$.15	$.60	$.50	$.75	$.52	$.35
" "	8 to 14 " 1,000 " "	.70	.60	.81	.89	1.00	.80	.15	.90	.85	.97	.75	.45
" "	14 to 20 " 100 " "	.10	1.00	.81	1.09	1.50	1.50	1.00	1.20	1.25	1.65	1.50	1.40
Rock excavation,	0 to 8 " 2,000 " "	4.00	4.00	4.00	4.29⅜	4.00	4.00	4.00	4.00	4.35	4.50	6.50	4.40
" "	8 to 14 " 300 " "	5.00	4.50	5.00	5.99	5.00	4.00	4.00	6.00	5.25	5.75	6.50	5.00
" "	14 to 20 " 40 " "	.10	5.00	.10	7.00	5.00	4.00	5.00	8.00	6.50	6.50	6.50	6.00
Brick masonry, 200 cu. yds.,....		5.50	5.00	5.00	5.34	4.00	6.00	5.50	5.50	5.50	5.35	4.00	5.90
Concrete " 120 " "		4.00	4.00	4.00	2.34	4.00	5.00	3.50	2.50	3.75	4.50	3.00	6.00
Rubble-stone masonry, 40 cu. yds.....		.10	3.00	.10	2.50	3.00	6.00	5.00	4.00	6.00	4.50	3.00	6.00
Pipe sewers, 6 to 12 in., 12,300 lin. ft...		.10	.10	.10	.07	.11¾	.06	.48	.07	.15	.12	.06	.50
Pipe chimneys, 200 lin. ft.....		.10	.05	.04	.07	.06	.08	.10	.10	.10	.08	.04	.10
Sub-drain pipe laid, 1,700 lin. ft.....		.15	.20	.15	.24	.12	.15	.10	.20	.30	.20	.15	.30
Spruce lumber in place, 4,000 ft.....		2,00	25.00	$15	19.00	35.00	30.00	25.00	30.00	45.00	35.00	35.00	34.00
Spruce piles driven, 200 lin. ft.....		.02	.25	.05	.45	.25	.30	.25	.30	.45	.35	.40	.25

* Somerville. ** South Braintree.

INDUSTRIAL NOTES.

THE CUMBERLAND MFG. CO., of Boston, has just completed a 3,500,000-gallon mechanical filter plant for the Knoxville (Tenn.) Water Co.

F. B. HAWKINS & CO., of New York and Boston, as agents of the Anniston Pipe & Foundry Co., have contracted to supply 12,000 ft. of 30-in. cast iron pipe to the city of Albany, and 800 tons of pipe to Medford, Mass.

QUEEN & CO., of Philadelphia, makers of engineering and mathematical instruments, have been reported as in financial difficulties. It now seems likely that an arrangement will be made with the company's creditors whereby the business will be continued without liquidation.

THE BROOKS LOCOMOTIVE WORKS, at Dunkirk, N. Y., on Aug. 21, completed and tested the first of an order for 60 locomotives for the Brazilian government, to run on the Brazil Central Railway. It is a 21 × 26-in. cylinder, 12-wheel, or mastodon type. It weighs 172,000 lbs. and is made for a 5 ft. 3 in. gage.

THE PIERPOINT BOILER CO., of Pittsburg, Pa., manufacturing the Pierpoint water-tube boilers, has a contract for 500 HP. in boilers of this type for the Philadelphia Natural Gas Co., at Murraysville, P. The firm is also erecting boilers of 2,500 HP. in the new shops of the Westinghouse Electric & Mfg. Co., at Brinton, Pa.

THE RICE & SARGENT ENGINE CO., of Providence, R. I., has received an order for the steam engine to be used in the new plant of the American Machine Co., manufacturers of cotton machinery at Pawtucket, R. I. The engine will be a 20 × 42-in., the first half of a double engine, the remainder to be added when needed.

THE NATIONAL SWITCH & SIGNAL CO. has been awarded the contract for installing interlocking plants at Springfield Junction for the Long Island R. R. at Philadelphia, for the Philadelphia & Reading R. R. and also for the Lehigh & Hudson R. R., and a system of station and facing point signals for the Delaware, Susquehanna & Schuylkill R. R.

MR. LEWIS M. LOSS has opened an office in the Bort Building, Chicago, which will hereafter be the headquarters from which his general contracting business will be conducted. Mr. Loss has been actively identified with this line of business for over 40 years, and during that time has carried to successful completion some of the largest contracts which have been executed in this country, and in Canada. Among the important works built by him are the substructures for the Cairo, Ill., Memphis, Tenn., and Alton, Ill., bridges.

THE PITTSBURG ARCHITECTURAL IRON WORKS have begun the erection of a new plant at Canonsburg, Pa., which will occupy about seven acres of ground. The foundations for the buildings are being laid by Chas. Trautwein & Co. The plant will consist of a bridge and construction shop 175 × 360 ft.; general foundry, 75 × 160 ft., blacksmith and boiler house, 40 × 100 ft.; and pattern and storehouse, 40 × 100 ft. The buildings will be built of iron, and will be fireproof. This will make three plants that the company now operates, the others being in Uniontown and Pittsburg.

THE INGERSOLL-SERGEANT DRILL CO. has added to its business a special department for the manufacture and sale of the Pohle air lift pump, which will be under the direct supervision of its inventor, Dr. Julius G. Pohle. This novel and interesting system of pumping was fully described in our issue of June 8, 1893, and we have recently (July 12) published tests made upon it at De Kalb, Ill. We are informed that over 100 of these pumping plants are now in satisfactory use and the field for its advantageous application seems to be a very large one, including especially non-flowing artesian wells, brine wells, and the handling of corrosive liquids, such as mine water, and acid or alkaline solutions. Further particulars with reference to experience with the system may be obtained by application to the Ingersoll-Sergeant Drill Co., Havemeyer Bldg., New York.

THE MORGAN ENGINEERING CO., of Alliance, O., has an order from the Carnegie Steel Co. (for the Edgar-Thomson Steel Works) for three of its patented electric overhead traveling charging cranes, for the purpose of charging and drawing ingots in vertical heating furnaces. About a year ago the company erected a crane of a similar character at the same works, the operations of which are so satisfactory that the management has determined to change the horizontal heating furnaces to those of the vertical type, and is putting in these three additional charging cranes to handle the entire product of the blooming mill in connection with the rail mills. The company is also constructing a 10-ton crane of 60-ft. span for the Carnegie Co.'s foundry, making in all 22 cranes, each operated by electric motors, which have been furnished to this works by the Morgan company. The Morgan company is also erecting two overhead traveling charging cranes, similar to those for the Carnegie Co., at the works of the Ohio Steel Co., Youngstown, O., in addition to a crane of 15 tons capacity, 75 ft. span, recently put in, and it has recently booked orders for a 15-ton 50-ft. span traveling crane for the Laidlaw-Dunn-Gordon Co., Cincinnati; a 15-ton 50-ft. span and a 3-ton locomotive type crane (both operated by electric motors) for the American Machine Co., Pawtucket, R. I.; one of 20 tons, 70 ft. span, and one of 40 tons, 40 ft. span, for Mackintosh, Hemphill & Co., Pittsburg, making in all seven cranes furnished this company. It is also building a 5-ton traveling crane of 30 ft. span for the Youngstown Steel Co.; one of 25 tons, 58 ft. span, for the Standard Steel Works, Burnham, Pa., and is erecting two specially constructed patented traveling cranes for handling blooms in and out of horizontal heating furnaces for Jones & Laughlins, Pittsburg, in addition to two electric traveling tables for serving the blooming mill. It has also built two traveling tables, all motions operated by electric power, for the blooming mill of the Cambria Iron Co., Johnstown, Pa. Besides all these it has recently shipped a traveling crane of 30 tons capacity, 75 ft. span, fitted with double trolleys, to the American Steel Foundry Co., St. Louis; one 20-ton crane, supplied with the patented auxiliary hoist, to the United Verde Copper Co., Granite Station, Ariz., and one 25-ton, 55 ft. span, traveling crane to the Johnson Co., Johnstown, Pa., this being the second furnished this company. The Morgan Engineering Co. claims that it makes application of electric motors to more machinery of this class than any concern in this country. It is also turning out large quantities of hydraulic and steam machinery not enumerated in the above list. The above is certainly a most creditable record in these times of slack business.

TRACK EXHIBITS AT THE NEW ENGLAND ROADMASTERS' ASSOCIATION MEETING.

The following is a list of the principal exhibits shown at the convention of the New England Roadmasters' Association Convention, held in Boston, last week:

M. H. Brown, 96 Broadway, New York.—This exhibit consisted of a rail bender, similar to the Emerson rail bender, having clamps to fit over the rail head, and a bending punch, operated by a long wooden lever working in a vertical plane.

Continuous Rail Joint Co., Newark, N. J.—This company's joint consists of two angle bars with a double flange fitting tightly around the edges of the rail base, and thus forming a base support or bridge joint. There is sufficient elasticity to enable the bar to accommodate itself to any irregularity in the rail, and it can be used also on old rails. The Boston & Maine R. R. has about 60 miles of track laid with this joint. The bars are of 0.1% carbon steel, and are rolled to the proper section. They may be made of the Sayre section for